FINAL

■■■■■ THIRD YEAR LONG-TERM MONITORING ANNUAL REPORT - LONG-TERM MONITORING OF SOLDIER CREEK TINKER AFB OKLAHOMA CITY, OKLAHOMA

CONTRACT NUMBER
F34650-93-D-0109
ORDER 5025

Prepared for
Department of the Air Force
Tinker AFB
Oklahoma City, Oklahoma

August 1999

FINAL

THIRD YEAR LONG-TERM MONITORING ANNUAL REPORT-LONG-TERM MONITORING OF SOLDIER CREEK TINKER AFB OKLAHOMA CITY, OKLAHOMA

CONTRACT NO. F34650-93-D-0109
ORDER 5025

Prepared for
Department of the Air Force
Tinker AFB
Oklahoma City, Oklahoma

August 1999

FINAL

THIRD YEAR LONG-TERM MONITORING ANNUAL REPORT FOR LONG-TERM MONITORING OF SOLDIER CREEK SEDIMENT AND SURFACE WATER OPERABLE UNIT

Document Prepared for:

Tinker Air Force Base
Environmental Directorate
OC-ALC/EM
Tinker AFB, Oklahoma

405-734-3058

This Final Long-Term Monitoring Annual Report is intended for use by Tinker and regulatory personnel. The document incorporates sediment and surface water data collected by Woodward-Clyde Federal Services during the third year of long-term monitoring, and the human health risk assessment III (HHRA III).

Outline of Document

- Introduction
- Background
- Investigation Methods
- Human Health Risk Assessment III
- Discussion of Monitoring Results
- Conclusions and References

Woodward-Clyde

Engineering & Sciences Applied to the Earth & Its Environment

August 13, 1999
WCFS Project No. F96526

Department of the Air Force
Headquarters Oklahoma City Air Logistics Center (AFMC)
OC-ALC/PKOSS
ATTN: Sharon Beatty
7858 5th Street, Suite 1
Tinker AFB, Oklahoma 73145-9106

Subject: Submittal of Final Third Year Long Term Monitoring Annual Report
Long-Term Monitoring of Soldier Creek
Contract No. F34650-93-D-0109, Order No. 5025
WCFS Document Control No. F96526.39

Dear Ms. Beatty:

In accordance with your letter dated July 29, 1999, this letter transmits the Final Third Year Long Term Monitoring Annual Report-Long Term Monitoring of Soldier Creek. One copy is enclosed here and eight copies have been submitted directly to Mr. James Dawson.

If you have any questions regarding this submittal, please contact the undersigned.

Sincerely,

David C. Convy
Project Manager

cc: James Dawson

Woodward-Clyde Federal Services - A subsidiary of Woodward-Clyde Group, Inc.
10975 El Monte, Suite 100 - Overland Park, Kansas 66211
(913) 344-1000 - Fax (913) 344-1010

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ACRONYMS

1Qtr1Yr	First Quarter First Year
2Qtr1Yr	Second Quarter First Year
3Qtr1Yr	Third Quarter First Year
4Qtr1Yr	Fourth Quarter First Year
1Qtr2Yr	First Quarter Second Year
2Qtr2Yr	Second Quarter Second Year
3Qtr2Yr	Third Quarter Second Year
4Qtr2Yr	Fourth Quarter Second Year
1Evnt3Yr	First Event Third Year
2Evnt3Yr	Second Event Third Year
AOC	Area of Concern
ACC	Air Combat Command
AFB	Air Force Base
AFMC	Air Force Materiel Command
bgs	Below Ground Surface
BHRA	Baseline Health Risk Assessment
CAA	Clean Air Act
CERCLA	Comprehensive Emergency Response and Compensation Liability Act
COC	Contaminant of Concern
CWA	Clean Water Act
DERP	Defense Environmental Restoration Program
DoD	Department of Defense
DRMO	Defense Reutilization and Marketing Office
EM	Environmental Management
EPA	Environmental Protection Agency
FFA	Federal Facilities Agreement
HEAST	Health Effects Assessment Summary Tables
HHRA	Human Health Risk Assessment
HI	Hazard Indices
HPLC	High Performance Liquid Chromatography
IRP	Installation Restoration Program

IRIS	Integrated Risk Information System
I-40	Interstate Highway 40
IWTP	Industrial Wastewater Treatment Plant
MCL	Maximum Contaminant Level
NCP	National Contingency Plan
NPDES	National Pollution Discharge Elimination System
NPL	National Priority List
OSDH	Oklahoma State Department of Health
OU	Operable Unit
PAH	Polyaromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SARA	Superfund Amendment and Reauthorization Act
STP	Sanitary Treatment Plant
SVOC	Semivolatile Organic Compounds
SWMU	Solid Waste Management Unit
TCE	Trichloroethene
TIC	Tentatively Identified Compound
TSCA	Toxic Substance Control Act
VOC	Volatile Organic Compound
USAF	United States Air Force
WCFS	Woodward-Clyde Federal Services

Long-term monitoring of the Sediment and Surface Water Operable Unit of Soldier Creek at Tinker Air Force Base is conducted in response to the signed Record of Decision (ROD), dated September, 1993. The focus of the monitoring program is to evaluate sediment and surface water contamination from the Soldier Creek Sediment and Surface Water Operable Unit.

This report summarizes findings from the third year of long-term monitoring. The first year of monitoring is presented in the Final Quarterly Monitoring Annual Report (WCFS, 1997a). The second year of monitoring is presented in the Draft Second Year Quarterly Monitoring Report (WCFS, 1997b). The third year of long-term monitoring occurred in January and July 1997. During the third year of monitoring, a total of 74 sediment and 29 surface water samples were collected from East and West Soldier Creeks and a sample location on Tributary B. Surface water samples were collected prior to sediment sampling. Sediment samples were collected at three intervals from 0-6 inches, 6-12 inches and 3-5 feet below ground surface (bgs). When refusal of the sampling device occurred prior to 5 feet bgs, a sediment sample was typically collected from the bottom one foot interval of the boring.

Samples were analyzed for volatile organics, semi-volatile organics, metals, polychlorinated biphenyl's (PCBs), and pesticides. Surface water samples were also analyzed for the following wet chemistry parameters: alkalinity, chemical oxygen demand, hardness, total dissolved solids, total organic carbon, total suspended solids, chloride, and sulfate. Surface water and sediment samples from 0-6 inches bgs were analyzed for hexavalent chromium. Surface water measurements performed in the field included temperature, pH, conductivity, dissolved oxygen, and flow.

An evaluation of risks associated with Soldier Creek surface water and sediments was previously performed by B&V in the Baseline Health Risk Assessment (BHRA) (B&V, 1993a). Human Health Risk Assessments I & II (HHRA I & II) (WCFS, 1997a and b) were performed for the first and second years of long-term monitoring. As part of this project, the Human Health Risk Assessment III (HHRA III) was performed to provide updated information on potential current and future risks based on current surface water and

sediment contaminant levels, compare the results with those of the HHRA I and HHRA II to see if the previous conclusions are still valid, and develop updated cleanup goals that are protective of the human populations.

Screening criteria were based on exposure factors developed by the BHRA for human health under the RI/FS, and the HHRA I. Analyte concentrations detected in sediment and surface water were screened against these screening criteria. Unacceptable exposures were determined based on the following criteria:

- Contaminant concentrations in sediment or surface water exceeding health levels based on an excess lifetime cancer risk of 10^{-4}
- Contaminant concentrations in sediment or surface water with non-carcinogenic hazard indices (HIs) greater than 1.0

Contaminant concentrations detected in the 10^{-4} to 10^{-6} range may potentially indicate an unacceptable exposure level and were also evaluated.

Surface water analyte concentrations from the third year of monitoring did not exceed any of the screening criteria set forth in the BHRA and the HHRA I.

Sediment analyte concentrations from the third year of monitoring did not exceed the 10^{-4} screening criteria set forth in the BHRA and the HHRA I. However, the HHRA I noncarcinogenic hazard screening criteria for aroclor 1254 was exceeded at one location in segment QW03 on West Soldier Creek.

BHRA 10^{-6} screening criteria were exceeded by five semivolatile (SVOCs) classified as polyaromatic hydrocarbons (PAHs). These include benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, and chrysene. HHRA I 10^{-6} screening criteria were exceeded by three PAHs benzo(a)pyrene, benzo(b)fluoranthene, and dibenz(a,h)anthracene. HHRA I 10^{-5} screening criteria were exceeded by benzo(a)pyrene in sediment samples. Based on the ROD, exceedance of these 10^{-5} and 10^{-6} screening criteria may potentially indicate a need to evaluate if the exposure is unacceptable.

The results of the risk characterization indicate that for all scenarios, potential cancer risks are below or within the USEPA advisory range of 10^{-6} to 10^{-4} and the USEPA noncarcinogenic health hazard of 1.0. These results indicate that exposure to surface water and sediments in West and East Soldier Creeks is not likely to result in an unacceptable cancer risk or noncarcinogenic hazard for any on-base or off-base populations under current or future stream use conditions.

The results of the HHRA III were compared to those from the two previous HHRAs (1997 a and b). In general, no dramatic changes between the first two HHRAs and the HHRA III were identified as part of a trend analysis. Therefore, no definitive statement can be made regarding trends at East and West Soldier Creeks based on these results. Although the Area 4 (off-base East Soldier Creek) cancer risks show a steady decline from HHRA I to HHRA III. The differences in estimated noncarcinogenic adverse health effects and carcinogenic risks are due to changes in contaminant concentrations and chemicals which were detected in the sediments and surface water. These differences are expected because the stream is a dynamic system affected by such factors as precipitation levels. Effluent outfall flow and concentrations also impact the dynamics of the stream system.

Despite slight differences in approach between the HHRAs and the BHRA, all risk assessments have concluded that there are no unacceptable cancer risks or non-carcinogenic hazards associated with exposure to East or West Soldier Creeks for any on-base or off-base populations, under current of future stream use conditions. Thus no remedial action appears to be warranted based on risks to human health.

1.0
INTRODUCTION

1.1 PURPOSE OF REPORT

This work was performed under Contract No. F34650-93-D-0109, Orders 5014 and 5025 between Tinker AFB and WCFS. The third year of long-term monitoring was performed on a semi-annual basis, and occurred in January and July 1997. This report describes the sampling methods, analytical results, and conclusions of the third year of long-term monitoring.

Results of the first year of quarterly monitoring is presented in the Final Quarterly Monitoring Annual Report (WCFS, 1997a). Results of the second year of quarterly monitoring is presented in the Draft Second Year Quarterly Monitoring Report (WCFS, 1997b).

1.2 REGULATORY BASIS

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 and the Superfund Amendments and Reauthorization Act (SARA) of 1986 established the Defense Environmental Restoration Program (DERP) for the U.S. Department of Defense (DoD) to clean up past hazardous waste disposal and spill sites nationwide. In 1980, the United States Air Force (USAF) began implementing the DoD Installation Restoration Program (IRP). The IRP is designed to identify and evaluate suspected problems associated with past hazardous waste management practices, including impacts on human health and the environment.

Two sites located within Tinker AFB, Building 3001 and Soldier Creek, were listed on the CERCLA National Priority List (NPL) in 1987. Tinker AFB, EPA Region VI, and the Oklahoma State Department of Health (OSDH) signed a Federal Facilities Agreement (FFA) (Administrative Docket Number NPL-U3-2-27) under Section 120 CERCLA in December 1988. The intent of this agreement is to ensure that past and present activities of Tinker AFBs NPL sites are thoroughly investigated and appropriately remediated to protect the public health, welfare, and the environment.

Long-term Monitoring of the Sediment and Surface Water Operable Unit of Soldier Creek at Tinker Air Force Base (Tinker AFB) was conducted in response to the signed Record of Decision (ROD), dated September, 1993.

1.3 INVESTIGATION SCOPE AND OBJECTIVES

The focus of this monitoring program is sediment and surface water contamination from the Soldier Creek Sediment and Surface Water Operable Unit (OU) from the headwaters of East and West Soldier Creeks to Interstate Highway 40 (I-40). The Soldier Creek OU is located in the northeast portion of Tinker AFB and was identified in the ROD as a potential threat to human health and the environment. The objective of long-term monitoring is to evaluate analytical results of sediment and surface water samples for exceedance of health based cleanup goals developed during the Baseline Health Risk Assessment (BHRA) (B&V, 1993a), and reported in the ROD (B&V, 1993b).

1.4 REPORT ORGANIZATION

This report describes the results of the third year of long-term monitoring of the Soldier Creek OU.

Section 1 is the introduction describing the purpose of this report, the regulatory basis of the study, and the objectives and scope of the monitoring program

Section 2 describes Tinker AFB and the project site. This section also summarizes site history and previous investigations

Section 3 describes sampling methods used during quarterly monitoring of sediments and surface water

Section 4 contains a brief summary of the Human Health Risk Assessment III presented in Appendix A

Section 5 contains a review and discussion of sampling results and analytical exceedances of screening criteria

Section 6 presents conclusions from the third year of long-term monitoring

Section 7 presents the list of references cited

2.1 INSTALLATION DESCRIPTION AND HISTORY

Tinker AFB is located in Oklahoma County in central Oklahoma approximately 8 miles southeast of downtown Oklahoma City. The base is bounded by Sooner Road to the west, Douglas Boulevard to the east, I-40 to the north, and Southeast 74th Street to the south. The base is comprised of approximately 5,277 acres. Municipalities of the metro area which adjoin Tinker AFB are Midwest City to the north, Del City to the northwest, and Oklahoma City to the east, south, and southwest (Figure 2-1). Midwest City and Del City are heavily populated with mixed residential and commercial areas. The area under Oklahoma City jurisdiction is lightly developed residential.

To attract the war industries in the early 1940's, Oklahoma City donated the land required for the facility and offered necessary improvements at no cost to the War Department. The Oklahoma Industries Foundation was established to bid for a military maintenance and supply depot and to acquire the land for the site. Oklahoma City was considered a favorable location for the depot for several reasons, including mild winters, flat terrain, and strategic location near the geographic center of the United States. During this period, Midwest City was formed as a new town to provide housing and community facilities for the air depot. The original site, consisting of 960 acres, was selected by the Army on May 21, 1941, seven months before the United States officially entered World War II.

The name designations for the Oklahoma City Air Depot and Tinker Air Field have changed several times over the life of the base, as the depot and air base were redesignated and reorganized. Tinker AFB was officially known as Midwest Air Depot during its construction, and then as the Oklahoma City Air Depot after it was activated. In January 1943, the name of the depot was officially changed to Oklahoma City Air Depot Control Area Command. In May 1943, the name was changed to Oklahoma Air Technical Area Service Command to reflect new responsibilities at the depot. The name changed again in July 1946, to Oklahoma City Air Material Area. In 1974, the depot was redesignated Oklahoma City Air Logistic Center to reflect the last change in function at the depot.

Pressure from local citizens was instrumental in the decision to name the air field at the depot "Tinker Field", honoring General Clarence L. Tinker. Tinker was an Osage Indian who died in 1942 while leading a bomber strike against the Japanese at Wake Island. Tinker Field became "Tinker Air Force Base" on January 13, 1948. Subsequently, the base became the worldwide repair depot for B-36 and B-45 aircraft, as well as a multitude of other weapons and engines.

The Oklahoma City Air Depot was partially operational in 1942. Tinker Air Field was built adjacent to and concurrently with the depot. The Douglas Cargo Airplane Plant was built in 1942-1943 to manufacture specially modified DC-3s. The depot and aircraft plant shared Tinker Air Field. After World War II, the Douglas Cargo Aircraft Plant was closed and the Air Depot took over the buildings and expanded the Base operations, to include facilities for testing and overhauling jet engines. During this time, Tinker AFB became involved in jet engine overhaul and, later, modification of aircraft from storage as part of a massive program to rebuild the nation's air power.

The Korean and the Cold War occurred during 1950-1959. As the decade began, the Tinker work force was much smaller than in the World War II days. The base was still a major employer with 10,000 people and was the home of the largest Air Depot in the United States.

TAFB was involved in many events that took place as the decade of the sixties unfolded. Tinker was one of the most active bases in the Air Force during the Cuban missile crisis, as aircraft used the installation as a stepping stone to and from the southeastern part of the United States. Even before this, Tinker's central location helped rank it fifth in takeoff and landing activity among all non-training Air Force bases.

During the early 1970s, the F-4 phantom became an important specialized repair workload at TAFB. On February 28, 1977, OC-ALC was named provisional manager of the ground launched cruise missile.

An important development during the 1980s was the increased emphasis on environmental management. In 1985, a separate Directorate of Environmental Management (EM) was formed at Tinker. The new Directorate incorporated functions related to environmental laws such as the Clear Air Act (CAA), Clean Water Act (CWA), Resource Conservation and

Recovery Act (RCRA), CERCLA as amended by SARA, and Toxic Substances Control Act (TSCA).

As early as 1983, measures to remediate sites at Tinker AFB contaminated by past activities were being undertaken under the Air Force IRP. As part of the overall IRP, Tinker AFB began a preliminary assessment of previous waste disposal sites in 1981. As a result of a basewide sampling program in 1983, which detected trichloroethene (TCE) in the groundwater, extensive investigations were conducted in and around Building 3001. Two sites, Building 3001 and Soldier Creek were listed on the CERCLA NPL in 1987. In 1988, Tinker AFB signed the FFA with EPA and the State of Oklahoma to remediate these sites. A RCRA Facility Assessment (RFA) conducted in May 1989 identified 105 Solid Waste Management Units (SWMUs) and nineteen Areas of Concern (AOCs).

The base was issued a RCRA Part B permit on July 1, 1991. The permit specified that a RCRA Facility Investigation (RFI) be conducted for forty-three SWMUs and two AOCs. The Directorate of Environmental Management has now grown to approximately eighty personnel and works closely with the Bioenvironmental Office and the Office of Safety.

In 1992, major organizational changes occurred in response to the end of the cold war and the down sizing of the entire military structure. Of most importance to the OC-ALC is the fact that on July 1, 1992, its parent command, Air Force Logistics Command (AFLC), was merged with the Air Force Systems Command to form the Air Force Materiel Command (AFMC). The new command comprises 52 percent of the Air Force budget. Eighteen percent of all Air Force personnel and 42 percent of the civilian workforce are assigned to the new command.

During 1992, the L-62 Strategic Communications Wing of the U.S. Navy was installed at Tinker AFB. The L-62 Strategic Communications Wing is composed of two squadrons of aircraft that maintain communications with the Navy's submarines.

2.2 SITE DESCRIPTION AND HISTORY

The Soldier Creek Sediment and Surface Water OU was defined by the ROD as the two unnamed tributaries to Soldier Creek that originate on Tinker AFB (Figure 2-2). The

tributary east of Building 3001 is designated East Soldier Creek and the tributary west of Building 3001 is designated West Soldier Creek. The boundaries for the study were:

- All sediment and surface water of East Soldier Creek that originates on Tinker AFB to the intersection of East Soldier Creek and I-40 north of Tinker AFB

- All sediment and surface water of West Soldier Creek that originates on Tinker AFB to the intersection of West Soldier Creek and I-40 north of Tinker AFB

These initial boundaries included the ditches leading from the thirteen outfalls, eight of which are National Pollutant Discharge Elimination System (NPDES) outfalls, to East and West Soldier Creeks. The boundaries also included the lower portion of Tributary B, as defined in the Remedial Investigation/Feasibility Study (RI/FS) (B&V, 1993c), just upstream of its confluence with East Soldier Creek.

Data from the RI indicated that a contaminant concentration gradient exists to a point just south (upstream) of the study boundary. The study area boundary was established based on the following criteria:

- Limits of measurable levels of contaminants (as compared to background locations)

- Area of such size that a definitive assessment could be performed

- Allowance for source identification

2.2.1 East Soldier Creek

East and West Soldier Creeks drain the northeastern portion of Tinker AFB. Both streams are first-order (headwater) tributaries that have been substantially modified over the years (Figure 2-2). East Soldier Creek now originates where several storm sewers, known as Outfalls H, I, and J, emerge from the north side of 44th Street (north of Building 3705). The emerged portion of East Soldier Creek flows northward about 500 feet and is joined by a

tributary from the west which is fed by process effluent and cooling water blow-down (Outfall G). The combined flow continues about 630 feet northward along the east side of Building 3001 to a culvert at Bradley Drive, near which two storm water ditches (Outfalls M and L) enter from the west. This portion of the creek flows in a narrow channel through dense woods. The substrate is mainly bedrock (sandstone), with occasional areas of gravel and sand; virtually no fine-grained depositional sediment is present in this portion of East Soldier Creek.

After crossing under Bradley Drive, East Soldier Creek has a short stretch of flowing water and then becomes an elongated pond, about 600 feet long by 75 feet wide and terminating at a dam. Approximately midway along the pond a tributary fed from process effluent and storm water discharge (Outfall F) enters from the west. Except for the flowing stretch near Bradley Drive, the entire ponded portion of East Soldier Creek is depositional, with relatively thick organically rich silt and fine sand sediments.

Normal flows from the ponded portion of East Soldier Creek are diverted via underground piping through a concrete detention basin (former oil/water separator). Downstream from the dam the stream has a divided channel, the easternmost is fed by the culvert from the detention basin, and the westernmost of which during normal flow is backwater and during storm events is fed by the dam overflow. Between the dam and Douglas Boulevard, East Soldier Creek bends eastward. This stretch is about 400 feet long, varying from about 20 to 40 feet in width with sand, silt and gravel substrate and moderate flows. The Industrial Wastewater Treatment Plant (IWTP) and Sanitary Treatment Plant (STP) outfall to East Soldier Creek is located about a third of the way between the dam and Douglas Boulevard. The IWTP receives industrial process wastewater for treatment from the Building 3001, as well as process wastewater from other industrial sources throughout the base, via a network of underground piping. In April 1996, the IWTP/STP discharge was rerouted to the Oklahoma City Public Owned Treatment Works, and discharge to East Soldier Creek ceased. The IWTP is currently utilized for pretreatment of industrial waste. In case of emergency, discharges to East Soldier Creek from the IWTP/STP may occur under NPDES Permit OK1571724391.

Near where the stream exits Tinker under Douglas Boulevard, a large storm water conveyance enters from the north. Beyond Douglas Boulevard, East Soldier Creek flow east-northeastward about 800 feet and is joined by an intermittent tributary (Tributary B) from the

south. The stream then flows north-northeast about 1,200 feet to I-40. This off-base stretch is in a deeply incised channel with steep clay banks, surrounded by commercial and residential property near Douglas Boulevard and riparian woodlands beyond Tributary B. Tributary B headwaters are located just upstream of S.E. 36th Street where it flows northward to its confluence with East Soldier Creek north of S.E. 36th Street and east of Douglas Boulevard. East Soldier Creek begins to assume a quasi-natural riffle-and-pool configuration in this stretch, with natural substrates predominated by gravel, sand, and silt. There are also substantial amounts of concrete rubble and other anthropogenic debris (e.g., discarded appliances, automobile parts, household trash) in this section of the stream. Beyond I-40, East Soldier Creek flows northward to its confluence with the mainstream of Soldier Creek, which originates off-base near Southeast 59th Street, about 1.5 miles south-southeast of the Building 3001 Complex.

Table 2-1 presents the buildings and associated outfalls which contribute discharge to East Soldier Creek.

2.2.2 West Soldier Creek

West Soldier Creek starts between the Tinker North/South runway and Building 3001 in a broad grassy swale (Figure 2-2). It flows northward about 3,500 feet and is fed by runoff from the runways and the area west of Building 3001 and from several outfalls (Outfalls A, B, C, D, and E), which normally discharge very little to no water. Table 2-1 presents the buildings and associated outfalls which contribute discharge to West Soldier Creek.

The drainage continues to a point opposite the north end of Building 3001, enters a storm sewer, and emerges off-base from under Industrial Road to flow parallel to and then cross under I-40. A small tributary, which drains the north parking lot to Building 3001, and undeveloped Tinker property, joins West Soldier Creek off-base, midway between Industrial Road and I-40. The off-base reach of West Soldier Creek is moderately incised, with substrates consisting of bedrock, gravel, sand, and substantial amounts of concrete rubble. Riparian habitat consists of a narrow band of trees along most of the highway side, and wooded slope on the base side. This reach is approximately 500 feet long and is divided by a spill containment structure midway from its emergence from on-base Tinker and the culverts at I-40. North of I-40, West Soldier Creek flows northeastward through a mixed residential/commercial area and joins the mainstream of Soldier Creek, just west of Douglas

Boulevard. From this point, Soldier Creek flows north-northwest approximately 3 miles to join Crutcho Creek, which continues northward about 2 miles and enters the North Fork of the Canadian River.

2.2.3 Previous Investigations

Table 2-2 presents a brief summary of previous activities conducted on or near the Soldier Creek OU under the IRP. On July 22, 1987, the Building 3001 Site and Soldier Creek Site were added to the NPL. In 1990 and 1991, B&V conducted a Phase I and a Phase II RI/FS to determine the extent of sediment and surface water contamination along East, West and Main Soldier Creek. The baseline health risk assessment performed by B&V (1993a) determined that the sediment and surface water of the Soldier Creek OU do not pose a risk to human health in excess of acceptable risk-based exposure levels established by the EPA. In accordance with the requirements of the ROD, the first year of Soldier Creek long-term monitoring occurred in November 1994, and January, April, and June 1995 and is presented in the Final Quarterly Monitoring Annual Report for Long-Term Monitoring of Soldier Creek Sediment and Surface Water Operable Unit (WCFS, 1997a). The second year of long-term monitoring occurred in October 1995, March, May, and August 1996 and is presented in the Draft Second Year Quarterly Monitoring Report for Long-Term Monitoring of Soldier Creek Sediment and Surface Water Operable Unit (WCFS, 1997b). Initial results of the ecological assessment of Soldier Creek is presented in the Final Ecological Assessment (WCFS, 1997c). Results for the additional ecological assessment, which occurred in June 1997, will be submitted under separate cover.

Sediment analyte concentrations from the first year of quarterly monitoring did not exceed the 10^{-4} screening criteria set forth in the BHRA and the HHRA. Therefore, according to the ROD, because contaminants of concern did not exceed the 10^{-4} screening criteria another alternative for remediation does not need to be evaluated (B&V, 1993b).

During the first year of quarterly monitoring, BHRA 10^{-6} screening criteria were exceeded by six PAHs (benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, and indeno(1,2,3-cd)pyrene), HHRA I 10^{-5} screening criteria were exceeded by one pesticide (heptachlor), and one PAH (benzo(a)pyrene), and HHRA I 10^{-6} screening criteria were exceeded by two pesticides (aldrin and heptachlor) and six semivolatiles (benzidine,

benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene).

The results of the HHRA I were compared to those presented in the BHRA. Despite slight differences in approach, both risk assessments concluded that there are no unacceptable cancer risks or non-carcinogenic hazards associated with exposure to East or West Soldier Creeks for any on-base or off-base populations, under current of future stream use conditions.

During the second year of quarterly monitoring, BHRA 10^{-6} screening criteria were exceeded by six SVOCs classified as PAHs (benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, and indeno(1,2,3-cd)pyrene), HHRA I 10^{-6} screening criteria were exceeded by two pesticides (aldrin and heptachlor) and six SVOCs (benzidine, benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene), and HHRA I 10^{-5} screening criteria were exceeded by one pesticide (heptachlor), and one SVOC (benzo(a)pyrene) in sediment samples.

Sediment analyte concentrations from the second year of quarterly monitoring did not exceed the 10^{-4} screening criteria set forth in the BHRA and the HHRA I. However, at location QW03 the non-carcinogenic screening criteria for aroclor 1254 was exceeded.

The results of the HHRA II were compared to those presented in the HHRA I. The results of the comparison between the HHRA I and HHRA II showed no dramatic changes. Although the non-carcinogenic screening criteria was exceeded by one sample on-base West Soldier Creek, under the worker scenario, the exceedance does not trigger an unacceptable non-carcinogenic hazard.

Surface water analyte concentrations from the first and second years of quarterly monitoring did not exceed any of the screening criteria set forth in the BHRA and the HHRA I.

TABLES

TABLE 2-1
SOLDIER CREEK
OUTFALLS AND ASSOCIATED BUILDINGS/STRUCTURES

Location	Outfall	Building	
West Soldier Creek	A	3001	Aircraft overhaul and modification facility
	B	--	Drains roadway
	C	3001	Aircraft overhaul and modification facility
	D	3001	Aircraft overhaul and modification facility
	E	3001	Aircraft overhaul and modification facility
		3108	Hydraulic test and calibration
	N	--	Drains Outfalls A, B, C, D, E
East Soldier Creek	F	3001	Aircraft overhaul and modification facility
	G	3001	Aircraft overhaul and modification facility
	H	2122	Airframe paint stripping
		2210	Accessories
		3001	Aircraft overhaul and modification facility
		3102	Hangar and Fire Station
		3105	Hangar and process vacuum heat treat area
		3220	Missles and Avionics
		3221	Blade repair
		3234	Jet engine test stands
		3703	Jet engine test stands
	I	2122	Airframe paint stripping
		2210	Accessories
		3001	Aircraft overhaul and modification facility
		3102	Hangar and Fire Station
		3105	Hangar and process vacuum heat treat area
		3220	Missles and Avionics
		3221	Blade repair
		3234	Jet engine test stands
		3703	Jet engine test stands
	J	--	Drains roadway and DRMO area
	L	3001	Aircraft overhaul and modification facility
	M	--	Drains roadway

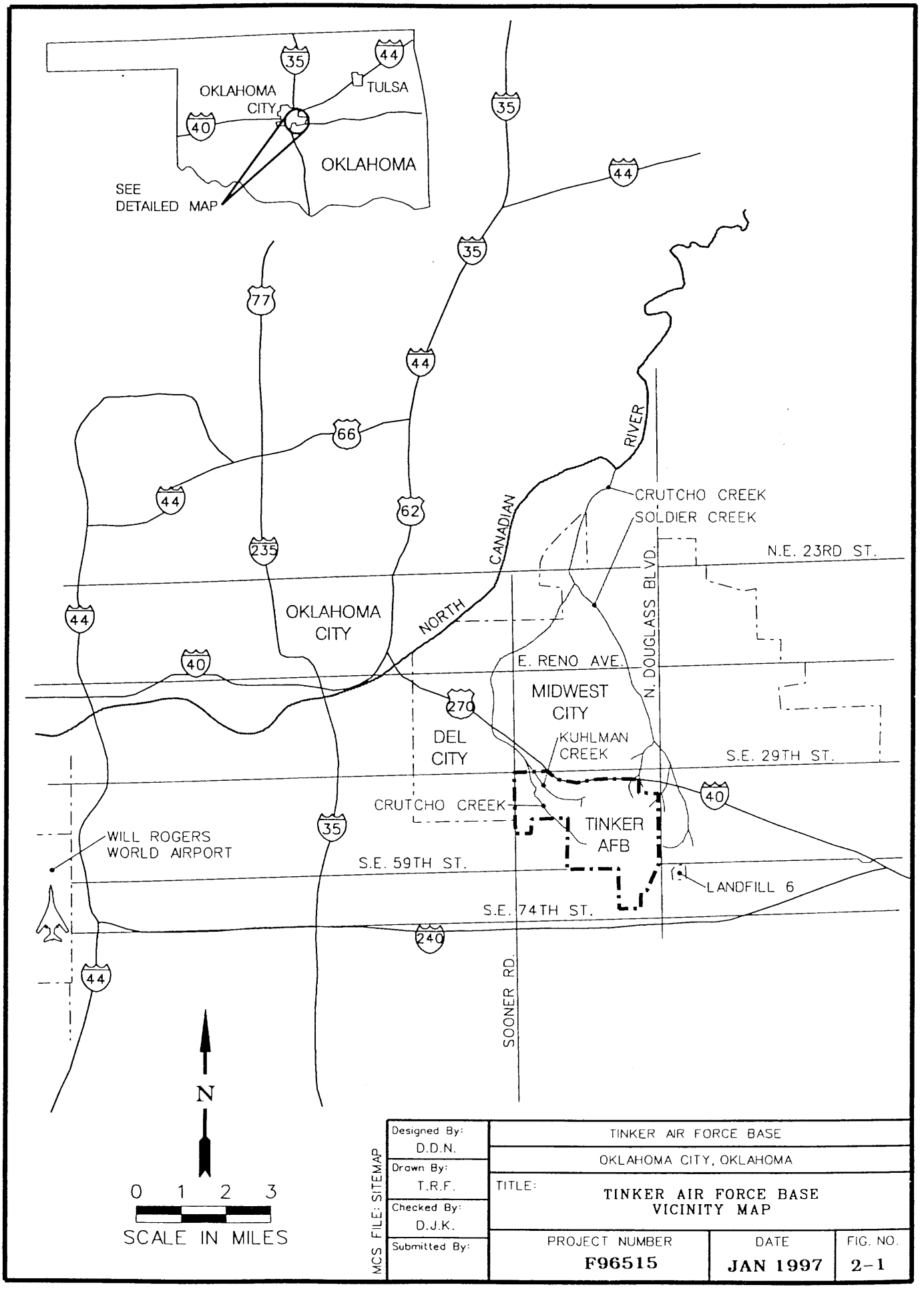
Adapted from NUS (1989)

TABLE 2-2
SUMMARY OF PREVIOUS INVESTIGATIONS AND ACTIVITIES

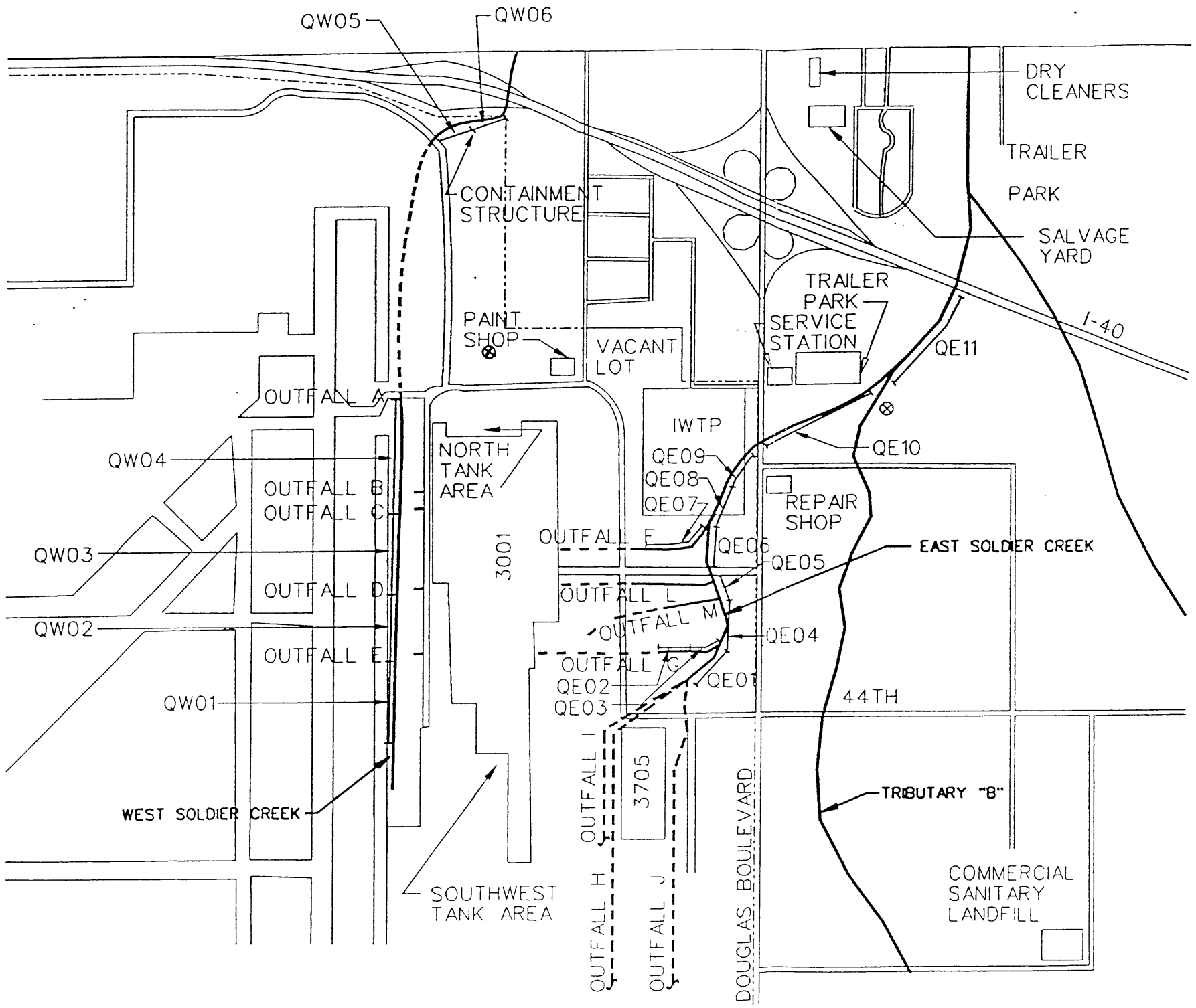
INVESTIGATION/REPORT	ORGANIZATION	DATE
Quarterly Groundwater Sampling	Tulsa COE	December 1987 - March 1989, March and October 1988
Surface Water Sampling	Tinker AFB	March - September 1987
Sediment and Surface Water Sampling	Oklahoma State Department of Health	June 1987
NPDES Surface Water Sampling	Tinker AFB	September 1986 - July 1987
Sediment and Surface Water Sampling	EPA	October 1984, November 1984
Sediment Sampling and Dredging	Harry Keith & Sons, Inc.	October 1985, April and May 1986
Final Storm Sewer Investigation for Soldier Creek	NUS Corporation	October 1989
Industrial Wastewater Treatment Plant Remedial Investigation	Tulsa COE	March 1988 - September 1990
Soldier Creek Remedial Investigation, Phase I and II	B&V Waste Science and Technology Corporation	July 1990, June 1991
Soldier Creek Baseline Risk Assessment	B&V Waste Science and Technology Corporation	February 1993
Soldier Creek Record of Decision	B&V Waste Science and Technology Corporation	August 1993
Workplans for Long-Term Monitoring and Ecological Assessment of Soldier Creek	Woodward-Clyde Federal Services	June 1994
Draft Ecological Assessment	Woodward-Clyde Federal Services	January 1996
Long-Term Monitoring of Sediment and Surface Water	Woodward-Clyde Federal Services	November 1994, January, April, July, and October 1995, March, May, and August 1996, January and July 1997
Soldier Creek/Off-Base Groundwater Operable Unit, Remedial Investigation	Parsons Engineering Science	July 1995

source: B&V 1993, and PES 1995

FIGURES



MCS FILE: SITEMAP	Designed By: D.D.N.	TINKER AIR FORCE BASE	
	Drawn By: T.R.F.	OKLAHOMA CITY, OKLAHOMA	
	Checked By: D.J.K.	TITLE: TINKER AIR FORCE BASE VICINITY MAP	
	Submitted By:	PROJECT NUMBER F96515	DATE JAN 1997
			FIG. NO. 2-1



LEGEND:

- SOLDIER CREEK AND TRIBUTARIES
- UNDERGROUND PORTION OF CREEK
- BOUNDARY OF TINKER AIR FORCE BASE
- ⊗ SAMPLING LOCATION ON TRIBUTARY B

N

1000 0 1000 2000

SCALE FEET

MCS FILE: F94506A

Designed By: D.D.N.	TINKER AIR FORCE BASE
Drawn By: D.R.T.	OKLAHOMA CITY, OKLAHOMA
Checked By: L.S.Y.	TITLE: SOLDIER CREEK QUARTERLY MONITORING SAMPLING SEGMENTS
Submitted By:	PROJECT NUMBER F93506 / DATE 01/12/95 / FIG. NO. 2-2

3.1 SAMPLING LOCATIONS AND LABELING

During the third year of the long-term monitoring program, sampling frequency was reduced from quarterly to semi-annual sampling and analysis of sediment and surface water within the segments identified in Figure 2-2. On-base sampling segments included four segments along West Soldier Creek (QW01-QW04), and nine segments along East Soldier Creek (QE01-QE09), and a sample location on a tributary or drainage ditch to West Soldier Creek (QW07). The additional sampling location (QW07) was added to a tributary or drainage ditch to West Soldier Creek during the second quarter of the second year sampling event. The sample location, QW07, is located at the culvert on the northeast corner of the Building 3001 north parking lot, north of Industrial Boulevard.

The off-base portion of Soldier Creek bounded by I-40 has been split into four segments, two on West Soldier Creek (QW05, QW06), two on East Soldier Creek (QE10, QE11) and a sample location on Tributary B (TR01), just above the confluence with East Soldier Creek, east of Douglas Boulevard. Stream segments were established based on the locations of known outfalls and structures (i.e., spill containment structures), known or suspected areas of contamination, stream morphology, and in conjunction with Tinker AFB EM personnel familiar with the project (WCFS, 1994). Table 3-1 presents the boundaries for each stream segment.

Sampling occurred quarterly for the first two years of long-term monitoring. Each stream segment was divided into quarters (sections). During each quarterly event, a different section of the stream segment was sampled progressing from upstream the first quarter to downstream with each subsequent event (Figure 3-1). The rationale for sub-dividing the stream segments into sections was to better characterize Soldier Creek surface water and sediment quality temporally and spatially. This sampling methodology was set forth in the ROD (B&V, 1993b).

Locations for semi-annual sampling were based on results from the first two years of quarterly monitoring for each segment of stream. Using sediment concentrations of PAHs as a guide (since they consistently exceed BHRA 10^{-6} screening criteria), the two most

contaminated sample locations from each stream segment were selected for sampling during semi-annual monitoring. In the event that PAHs did not exceed the health criteria, best professional judgment was used to determine which locations to sample based on other contaminant concentrations (i.e., PCB concentrations in the second and third quarter segments of QE03). If a segment was "equally" contaminated or there were no significant differences in contamination, the first and third quarter sections of a segment were selected for sampling. During the 1Evnt3Yr monitoring event, the upstream most section of each segment was sampled, and during the 2Evnt3Yr monitoring event, the downstream most section of each segment was sampled.

Data presented in the First Event Third Year Sampling Report (WCFS, 1997d) indicated QE11 would be sampled at the third quarter location during the 2Evnt3Yr monitoring event, however, the location could not be positively identified in the field. Therefore, QE11 was sampled at the fourth quarter sampling location, at the I-40 bridge, during the 2Evnt3Yr monitoring event. Two additional exceptions to the above described sample location rationale were at Tributary B and QW07, where the same location was sampled during all sampling events. Due to the grade of QW07, sufficient water for sampling was available only near the outlet of the outfall. Table 3-2 presents the quarterly monitoring locations as they correlate to the third year(semi-annual) monitoring locations. Figure 3-2 illustrates the sample locations within each sampling segment for semi-annual monitoring.

Samples were collected from a representative location along the stream channel. Sample locations within the section of the stream segment being sampled were determined in the field. Basic criteria for determining a representative sample location included flow, depth, deposition, occurrence of discolored sediments, and change in stream morphology.

3.1.1 Sediment Sampling

Depending on the water column depth and sediment characteristics, a trowel, ponar dredge, or hand auger/multi-stage sampler was used to collect sediment samples. Stainless steel trowels were used to collect samples from the 0-6 inch interval. In areas where the water column was too deep to use a trowel, a stainless steel hand auger/multi-stage sampler was used. Sediment samples obtained from 6-12 inches and 3-5 feet were also collected using a stainless steel hand auger.

For discrete sample collection using the trowel, the sampling area was first cleared of vegetation and/or debris. The sample was collected from the upper 6 inches. Upon reaching the surface, the sample was placed in a stainless steel bowl or on a clean sheet of aluminum foil. The sample for volatile and semi-volatile analyses was placed immediately into sample containers. Free water obtained during sample collection was used to eliminate headspace in the volatile and semi-volatile sample containers. The remaining portion of the sediment sample was composited and then transferred to the appropriate containers based upon analysis to be performed. Any remaining free water from the sample collection was returned to the stream. To the extent practical, the sample hole was backfilled with native sediment and vegetation.

For deeper samples, the hand auger sampler was lowered to the sediment surface and manually augured to the desired sampling depth or to refusal of the device. Upon reaching the surface, the sample was placed on a clean sheet of aluminum foil. The sample for volatile and semi-volatile analyses was placed immediately into sample containers. Free water obtained during sample collection was used to eliminate headspace in the volatile and semi-volatile sample containers. The remaining portion of the sample was composited and then transferred to the appropriate containers based upon analysis to be performed. Any remaining free water from the sample collection was returned to the stream. To the extent practical, the sample hole was backfilled with native sediment and vegetation.

3.1.2 Surface Water Sampling

Surface water samples were collected prior to sediment sampling and were obtained from the same location as sediment samples. Care was taken not to disturb the sediments during sampling. When possible, high velocity areas were avoided due to increased volatilization in turbulent waters. Stagnant waters were unavoidable in many segments due to the intermittent nature of the streams. Grab surface water samples were collected by submerging glass or stainless steel sampling devices directly into the creek. The opening of the container faced upstream. The water was then transferred directly into the sample containers and submitted for laboratory analysis.

Field parameters were conducted on surface water samples. These parameters included pH, specific conductance, temperature, and dissolved oxygen. Field measurements were recorded on field sheets. A total of four replicates were measured and averaged for each parameter.

Volumetric stream flow in each segment was estimated by determining the cross-sectional area and measuring current velocities across a representative transect in accordance with USGS flow-measurement techniques (wading method) (USGS, 1984).

3.1.3 Sample Identification

Each sample was identified by a specific field identification number which indicates site name, sampling location, sample type, and sequence number. An example of the sample identification number *SC-QE01-SD-1001* is as follows:

- SC - indicates the site name (Soldier Creek Sediment and Surface Water Operable Unit)
- QE01..QE11 - indicates sample segment on East Soldier Creek
- QW01..QW07 - indicates sample segment on West Soldier Creek
- TR01 - indicates the sample location on Tributary B
- SW - indicates surface water
- SD - indicates sediment

The last three or four digit code is the sequence identifier. For the first nine monitoring events, the first digit of the sequence identifier indicates the event being sampled and the sample location within a stream segment (i.e., 1XX through 9XX for sampling events 1 through 9). Subsequent events are indicated by the first two digits of the sequence identifier (i.e., 10XX for the 2Evnt3Yr monitoring event). The last two digits indicate, in sequence, the samples taken from each location. The last two digits always begin with 01 at each location. Duplicate samples for each sampling event were identified by adding 500 to the sequence identifier of the corresponding sample (i.e., SC-QE01-SD-1001 duplicate would be identified as SC-QE01-SD-1501).

In the above example, 1001 indicates the first sample (i.e., 0-6 inches) taken during the 2Evnt3Yr monitoring event, and 1002 indicates the second sample (i.e., 6-12 inches), taken during the 2Evnt3Yr monitoring event.

3.2 ANALYTICAL PARAMETERS

Sediment and surface water samples were analyzed for volatile organics, semi-volatile organics, metals, polychlorinated biphenyl's and pesticides. Sediment for 0-6 inches bgs and surface water samples were also analyzed for hexavalent chromium. In addition, surface water samples were analyzed for the following wet chemistry parameters: alkalinity, chemical oxygen demand, hardness, total dissolved solids, total organic carbon, total suspended solids, chloride, and sulfate. Table 3-3 presents a list of analytes by method and reporting limits. Actual sediment reporting limits were raised due to percent moisture in the sediment and elevated analyte concentrations.

A summary of the constituents for analysis, containers, preservation, and holding times are presented in Table 3-4. Due to the short holding time, samples collected for hexavalent chromium analysis were analyzed locally by Southwell Analytical Laboratory, located in Oklahoma City, Oklahoma. The remaining analysis was performed by Quanterra Environmental Services of Arvada, Colorado.

3.3 DECONTAMINATION PROCEDURES

All sampling equipment was decontaminated prior to each sampling location and prior to initial use. Decontamination of equipment minimized the risk of cross-contamination to environmental samples from improperly cleaned sampling equipment and ensured that representative samples were obtained. Potable water for all decontamination activities was provided by Tinker AFB.

Equipment used in the cleaning or decontamination of field equipment included:

- Methanol, reagent grade
- Aluminum foil
- Disposable gloves
- Teflon and stainless steel squeeze bottles or sprayers

- Wash tubs of various sizes and scrub brushes
- Potable water
- High Performance Liquid Chromatography (HPLC) water
- Plastic sheeting
- Washwater containment tubs or containers

Equipment decontamination procedures that were employed in the Soldier Creek investigation are as follows:

- Only Teflon and stainless steel containers were used to dispense water, methanol, or other cleaning agents. No plastic containers were used.

- All personnel performing decontamination procedures wore appropriate protective clothing such as disposable gloves, rubber boots, etc., as specified by the Site Safety Officer.

- All decontamination waste fluids were collected in containers with secondary containment and were stored at the drum staging area until disposal.

- All surface water and sediment sampling equipment (e.g. stainless steel bowls, trowels, dredges, and samplers) was decontaminated using brushes and a laboratory-grade detergent/potable water solution, followed by a potable water rinse, a pesticide-grade methanol rinse, and a HPLC water rinse. All equipment was allowed to air dry before sampling. If not immediately used, all decontaminated sampling equipment was wrapped in aluminum foil before storage or reuse.

All cleaning or wash buckets or tubs were cleaned using laboratory grade detergent/potable water solution and potable water rinse upon mobilization and demobilization.

3.4 QUALITY CONTROL/QUALITY ASSURANCE

Quality Assurance (QA) procedures were performed in general accordance with the Quality Assurance Project Plan (QAPP) of the Workplans (WCFS, 1994). No deviations from the QAPP occurred in the field during the long-term monitoring events, with the exception of the

rate of QA sample collection. QA was collected at a rate of approximately 10 percent (i.e., 1 for every 10 samples) during the first two years of monitoring. Beginning the third year of long-term monitoring, field duplicates, matrix spikes, and matrix spike duplicates were collected at a rate of approximately 5 percent (i.e., 1 for every 20 samples).

One rinsate was collected for each day of sampling. These Quality Assurance/Quality Control (QA/QC) samples were collected to assess field sampling procedures (including decontamination) and field collection precision. Trip blank samples accompanied each cooler with samples for VOC analysis to assess potential cross-contamination. One field ambient blank for each monitoring event was collected by pouring HPLC water, used for decontamination of equipment and rinsate samples, directly into sample bottles. The ambient blank sample was collected to assess the effects of background conditions, potential sample container contamination, and the quality of the HPLC water.

A QA/QC review was performed by Quanterra and Southwell laboratories. A QA/QC data assessment was performed by WCFS which included full validation of at least twenty percent of the data, for each monitoring event, using the SW-846 methods (EPA, 1992) and the EPA Contract Laboratory Program (CLP) National Functional Guidelines for Organic and Inorganic Data Review (Guidelines) (USEPA, 1994a, 1994b). Data assessment is herein defined as the systematic, structured process of evaluating, editing, screening, checking, verifying, and reviewing to assure that analytical data are in compliance with established criteria and are valid for the intended use.

The full validation consisted of a review of SW-846 results summary sheets and instrument reports for QA/QC parameters such as matrix spikes (MS), matrix spike duplicates (MSDs), detection limits, calibrations, duplicate control samples (DCS), single control samples (SCS), chain of custody forms, sample preparations, holding times, etc. In addition the review, consisted of recalculating laboratory data and standard calibration curves, checking for transcription errors, and carefully checking chromatograms and reconstructed ion chromatograms. The purpose of the full validation is to evaluate whether laboratory performance and analytical data are in compliance with method requirements and project specifications for accuracy, precision, validity, and completeness.

The data assessment process provides information on analytical limitations of data based on regulatory or method specific QA/QC criteria. In addition, the review process assigns data

qualifiers and provides a statement concerning usability of data. To ensure the data gathered during the investigation activities are adequate; precision, accuracy, representativeness, completeness, and comparability (PARCC) parameter targets have been identified for Level III analyses during the development of Data Quality Objectives (DQOs) and planning of the field activities. Level III analyses included all laboratory analyses using EPA methods. Quality of the analytical data is indicated by the calculation of values for precision, accuracy, and completeness. The quantitative target values for precision, accuracy, and completeness are as follows:

- Precision = 20 percent
- Accuracy = control limits specified for the particular analysis
- Completeness = 90 percent

Comparability and representativeness are assessed in a qualitative evaluation of the data generated during the field investigation.

The data generated during the third year of monitoring at Soldier Creek, Tinker AFB were reviewed as described above. The data were evaluated to be usable as received from Quanterra, and Southwell labs with the qualifications noted in the validation reports for their stated and intended purpose. Complete results of data validation and signed Chain of Custody Forms are presented in the monitoring reports (WCFS, 1997d, and e).

TABLES

TABLE 3-1
LONG-TERM MONITORING STREAM SEGMENT BOUNDARIES

WEST SOLDIER CREEK ON-BASE PORTION	
Section 1 (QW01)	South Tank Area to Outfall E
Section 2 (QW02)	Outfall E to just above Outfall D
Section 3 (QW03)	Outfall D to just above Outfall C
Section 4 (QW04)	Outfall C to culvert opposite north end of Building 3001, where on-base above ground portion of West Soldier Creek ends.
Section 5 (QW07)	Single location located on tributary to West Soldier Creek at emergence from north-east corner of parking lot, north of Building 3001 .

WEST SOLDIER CREEK OFF-BASE PORTION	
Section 1 (QW05)	Above-ground reach from it's emergence at three culverts near Tinker Gate 7 to the spill containment structure
Section 2 (QW06)	Spill containment structure to Interstate 40

EAST SOLDIER CREEK ON-BASE PORTION	
Section 1 (QE01)	Mainstem from its emergence at 44th Street to just above the confluence of Outfall G
Section 2 (QE02)	Outfall G from its emergence east, half way to its confluence with the mainstem
Section 3 (QE03)	Outfall G from halfway to its confluence with the mainstem to the mainstem.
Section 4 (QE04)	Mainstem from Outfall G to just above the confluence of Outfall M
Section 5 (QE05)	Outfall M to Bradley Drive
Section 6 (QE06)	The long pool from Bradley Drive north to just above Outfall F
Section 7 (QE07)	Outfall F from its emergence to its confluence with the mainstem
Section 8 (QE08)	The mainstem from Outfall F to the dam on the mainstem
Section 9 (QE09)	The mainstem from the dam to the spill containment structure on Douglas Blvd.

EAST SOLDIER CREEK OFF-BASE PORTION	
Section 1 (QE10)	The mainstem from Douglas Boulevard to just above the confluence with Tributary B
Section 2 (QE11)	The mainstem from Tributary B to Interstate 40

TABLE 3-2
SEMI-ANNUAL MONITORING
SAMPLE LOCATIONS

Sample Segment	1Evnt3Yr (January 1997)	2Evnt3Yr (July 1997)
QE01	1st Quarter Location	4th Quarter Location
QE02	3rd Quarter Location	4th Quarter Location
QE03	1st Quarter Location	2nd Quarter Location
QE04	1st Quarter Location	3rd Quarter Location
QE05	1st Quarter Location	2nd Quarter Location
QE06	3rd Quarter Location	4th Quarter Location
QE07	1st Quarter Location	3rd Quarter Location
QE08	2nd Quarter Location	3rd Quarter Location
QE09	1st Quarter Location	3rd Quarter Location
QE10	1st Quarter Location	3rd Quarter Location
QE11	1st Quarter Location	4th Quarter Location*
TR01	1st Quarter Location	1st Quarter Location
QW01	1st Quarter Location	3rd Quarter Location
QW02	1st Quarter Location	3rd Quarter Location
QW03	1st Quarter Location	2nd Quarter Location
QW04	3rd Quarter Location	4th Quarter Location
QW05	1st Quarter Location	3rd Quarter Location
QW06	1st Quarter Location	3rd Quarter Location
QW07	1st Quarter Location	1st Quarter Location

Note: * The second event location for QE11 was originally identified as the third quarter sampling location. The location could not be positively identified in the field and was sampled at the fourth quarter location, at the I-40 bridge.

TABLE 3-3
ANALYTES AND REPORTING LIMITS

Analytes	Sediment[1]	Water
Recoverable Metals - Method 6010/6020		
Aluminum	10*	15
Antimony	6*	3
Barium	1*	1
Beryllium	0.2*	0.5
Cadmium	0.5*	0.3
Calcium	20*	200*
Chromium	1*	5
Cobalt	1*	0.5
Copper	2*	2
Iron	10*	100*
Lead	5*	1
Magnesium	20*	200*
Manganese	1*	0.2
Molybdenum	2*	1
Nickel	4*	0.2
Potassium	500*	5000*
Silver	1*	0.5
Sodium	500*	5000*
Thallium	200*	0.1
Vanadium	1*	0.5
Zinc	-	10
Selenium	0.5	5
Metals - Methods As(7060), Hg(7470/7471), Hexavalent Chromium (7196A)	**mg/kg**	**mg/L**
Arsenic	0.5	0.005
Mercury	.033	0.0002
Selenium	0.5	-
Hexavalent Chromium[2]	2.5	0.1
PCB's and Chlorinated Pesticides - Method 8080	**mg/kg**	**ug/L**
4,4'-DDD	3.3	0.01
4,4'-DDE	3.3	0.01
4,4'-DDT	3.3	0.01
Aldrin	1.7	0.005
alpha-BHC	1.7	0.005
alpha-Chlordane	1.7	0.005
Aroclor 1016	33	0.1
Aroclor 1221	33	0.1
Aroclor 1232	33	0.1
Aroclor 1242	33	0.1
Aroclor 1248	33	0.1

TABLE 3-3
ANALYTES AND REPORTING LIMITS

Analytes	Sediment[1]	Water
Aroclor 1254	33	0.1
Aroclor 1260	33	0.1
beta-BHC	1.7	0.005
delta-BHC	1.7	0.005
Dieldrin	3.3	0.01
Endosulfan I	1.7	0.005
Endosulfan II	3.3	0.01
Endosulfan sulfate	3.3	0.01
Endrin	3.3	0.01
gamma-BHC (Lindane)	1.7	0.005
gamma-Chlordane	1.7	0.005
Heptachlor	1.7	0.005
Heptachlor epoxide	1.7	0.005
Methoxychlor	17	0.05
Toxaphene	170	0.25
Volatile Organics - Method 8240/8260	**mg/kg**	**ug/L**
Acetone	10	10
Acrolein	100	100
Acrylonitrile	100	100
Benzene	5	5
Bromodichloromethane	5	5
Bromoform	5	5
Bromomethane	10	10
2-Butanone (MEK)	10	10
Carbon disulfide	5	5
Carbon tetrachloride	5	5
Chlorobenzene	5	5
Chloroethane	10	10
Chloroform	5	5
Chloromethane	10	10
Dibromochloromethane	5	5
Dibromomethane	5	5
trans-1,4-Dichloro-2-butene	5	5
Dichlorodifluoromethane	20	20
1,1-Dichloroethane	5	5
1,2-Dichloroethane	5	5
1,1-Dichloroethene	5	5
1,2-Dichloropropane	5	5
cis-1,3-Dichloropropene	5	5
trans-1,3-Dichloropropene	5	5
Ethylbenzene	5	5
Ethyl methacrylate	20	20
Iodomethane	5	5
2-Hexanone	10	10

TABLE 3-3
ANALYTES AND REPORTING LIMITS

Analytes	Sediment[1]	Water
Methylene chloride	5	5
4-Methyl-2-pentanone (MIBK)	10	10
Styrene	5	5
1,1,1,2-Tetrachloroethane	5	5
1,1,2,2-Tetrachloroethane	5	5
Tetrachloroethene	5	5
Toluene	5	5
1,1,1-Trichloroethane	5	5
1,1,2-Trichloroethane	5	5
Trichlorethene	5	5
Trichlorofluoromethane	5	5
1,2,3-Trichloropropane	5	5
Vinyl acetate	10	10
Vinyl chloride	10	10
Xylenes (total)	5	5
trans 1,2-Dichloroethene	5	5
Ethanol	--	--
2-Chlorethyl vinyl ether	10	10
Semivolatile Organics - Method 8270	**mg/kg**	**ug/L**
Acenaphthene	330	10
Acenaphthylene	330	10
Acetophenone	330	10
4-Aminobiphenyl	330	10
Aniline	330	10
Anthracene	330	10
Benzo(a)anthracene	330	10
Benzo(b)fluoranthene	330	10
Benzo(k)fluoranthene	330	10
Benzo(g,h,i)perylene	330	10
Benzo(a)pyrene	330	10
Benzyl alcohol	330	10
4-Bromophenyl phenyl ether	330	10
Butyl benzyl phthalate	330	10
4-Chloroaniline	330	10
bis(2-Chloroethoxy)methane	330	10
bis(2-Chloroethyl)ether	330	10
bis(2-Chloroisopropyl)ether/2,2'-oxybis (1-chloropropane)	330	10
4-Chloro-3-methylphenol	330	10
2-Chloronaphthalene	330	10
2-Chlorophenol	330	10
4-Chlorophenyl phenyl ether	330	10
Chrysene	330	10
Dibenz(a,h,)anthracene	330	10

TABLE 3-3
ANALYTES AND REPORTING LIMITS

Analytes	Sediment[1]	Water
Dibenzofuran	330	10
Di-n-butyl phthalate	330	10
1,2-Dichlorobenzene	330	10
1,3-Dichlorobenzene	330	10
1,4-Dichlorobenzene	330	10
3,3'-Dichlorobenzidine	660	20
2,4-Dichlorophenol	330	10
2,6-Dichlorophenol	330	10
Diethyl phthalate	330	10
p-Dimethylaminoazobenzene	330	10
7,12-Dimethylbenz(a)-anthracene	330	10
a,a-Dimethylphenethyl-amine	330	10
2,4-Dimethylphenol	330	10
Dimethyl phthalate	330	10
4,6-Dinitro-2-methylphenol	1600	50
2,4-Dinitrophenol	1600	50
2,4-Dinitrotoluene	330	10
2,6-Dinitrotoluene	330	10
Di-n-octyl phthalate	330	10
Diphenylamine	330	10
bis(2-Ethylhexyl)phthalate	330	10
Ethyl methanesulfonate	330	10
Fluoranthene	330	10
Fluorene	330	10
Hexachlorobenzene	330	10
Hexachlorobutadiene	330	10
Hexachlorocyclopentadiene	330	10
Hexachloroethane	330	10
Indeno(1,2,3-cd)pyrene	330	10
Isophorone	330	10
3-Methylcholanthrene	330	10
Methyl methanesulfonate	330	10
2-Methylnaphthalene	330	10
2-Methylphenol	330	10
3/4-Methylphenol	330	10
Naphthalene	330	10
1-Naphthylamine	330	10
2-Naphthylamine	330	10
3-Nitroaniline	1600	50
4-Nitroaniline	1600	50
Nitrobenzene	330	10
2-Nitrophenol	330	10
4-Nitrophenol	1600	10
N-Nitroso-di-n-butylamine	330	10
N-Nitrosodiphenylamine	330	10

TABLE 3-3
ANALYTES AND REPORTING LIMITS

Analytes	Sediment[1]	Water
N-Nitroso-di-n-propylamine	330	10
N-Nitrosopiperidine	330	10
Pentachlorobenzene	330	10
Pentachloronitrobenzene	1600	10
Pentachlorophenol	1600	10
Phenacetin	330	10
Phenanthrene	330	10
Phenol	330	10
2-Picoline	330	10
Pronamide	330	10
Pyrene	330	10
1,2,4,5-Tetrachloro-benzene	330	10
2,3,4,6-Tetrachlorophenol	1600	50
1,2,4-Trichlorobenzene	330	10
2,4,5-Trichlorophenol	1600	50
2,4,6-Trichlorophenol	330	10
Benzidine	2500	50
1-Chloronaphthalene	2500	50
Dibenz(a,j)acridine	--	--
Azobenzene	2500	50
Benzoic acid	2500	50
Wet Chemistry	**mg/kg**	**mg/L**
Hardness	NA	5
COD	NA	20
TOC	NA	1.0
TSS	NA	2
TDS	NA	10
ALK	NA	5
Chloride	NA	0.5
Sulfate	NA	0.5

NA - Not applicable

* Indicates Method 6010, all other metals by Method 6020

[1] Actual sediment reporting limits vary due to percent moisture, and preparation dilution

[2] Reporting units for sediment & surface hexavalent chromium analysis for second and third quarters second year monitoring were 20 mg/kg and 0.5 mg/L, respectively.

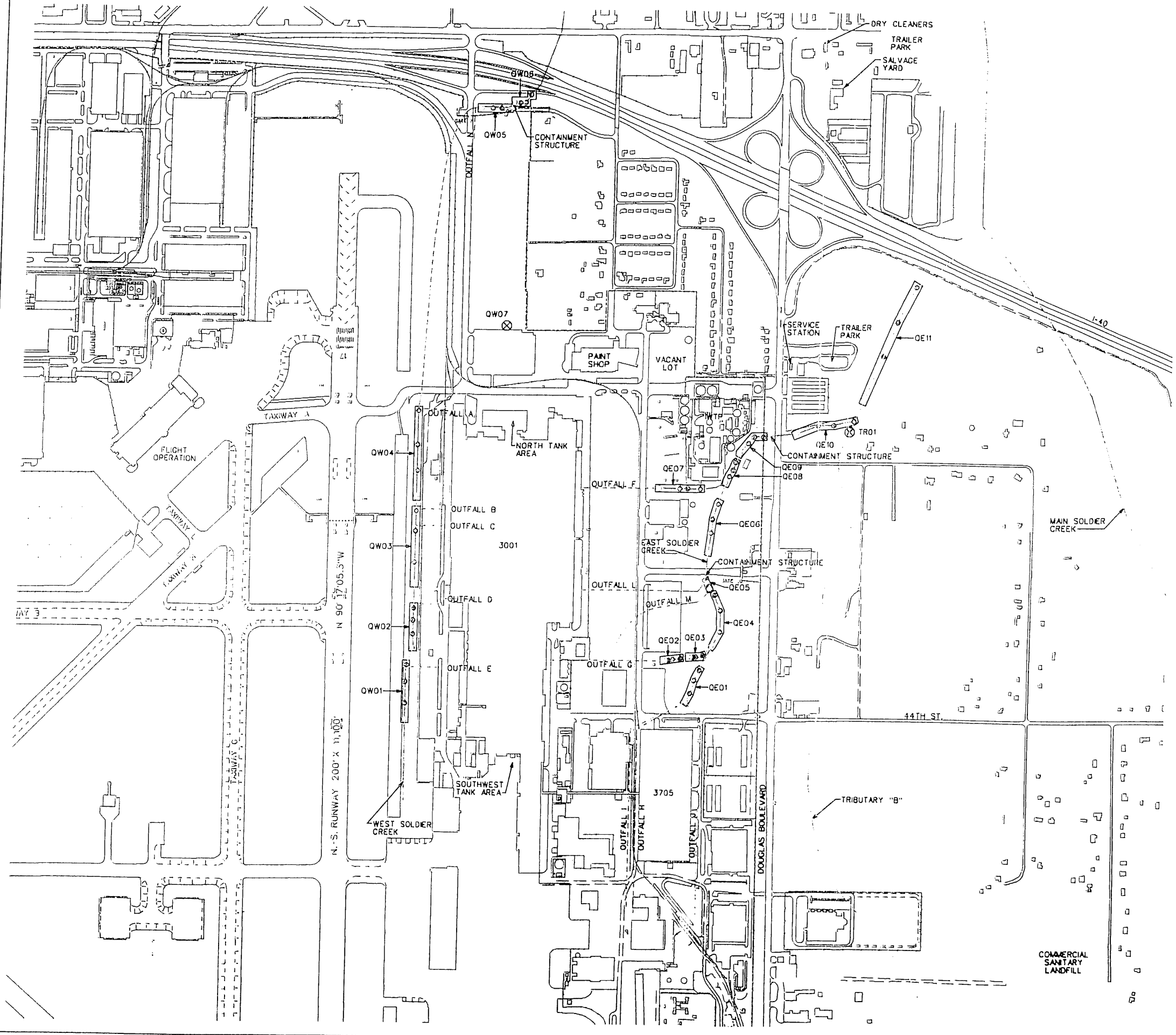
TABLE 3-4
ANALYTES, CONTAINERS, PRESERVATION, AND HOLDING TIMES

MEDIA	METHOD	PARAMETER	CONTAINER	PRESERVATION	HOLDING TIME
Sediment	SW-486 8240/8260	Volatile Organics	Two 4 oz. wide-mouthed jars	4° C	14 days
Sediment	SW-846 8270	Semivolatile Organics	*16 oz. wide-mouthed jars	4° C	14 days to extraction 40 days to analysis
Sediment	SW-846 8080	Pesticides (with PCB's)	*16 oz. wide-mouthed jars	4° C	14 days to extraction 40 days to analysis
Sediment	SW-846 6010/6020/7000	Metals	*16 oz. wide-mouthed jars	4° C	180 days Hg - 28 days
Sediment	7196	Hexavalent Chromium	4 oz. wide mouth jar	4° C	24 hours
Water	SW-846 8240	Volatile Organics	Three 40-ml. glass vial w/Teflon cap	4° C HCl pH<2	14 days
Water	SW-846 8270	Semivolatile Organics	Two 32oz glass (amber)	4° C	7 days to extraction 40 days to analysis
Water	SW-846 8080	Pesticides (with PCB's)	Two 32oz glass (amber)	4° C	7 days to extraction 40 days to analysis
Water	SW-846 6010//6020/7060/7470	Total Metals, As, Hg	One 500-ml plastic bottle**	HNO_3 pH<2	180 days Hg - 28 days
Water	6010/6020	Dissolved Metals	One 500-ml plastic bottle**	HNO_3 pH<2	180 days Hg - 28 days
Water	130.2	Hardness	One 500-ml plastic bottle**	HNO_3 pH<2	180 days
Water	410.4, 415.1	Chemical Oxygen Demand / Total Organic Carbon	One 16-oz glass	4° C H_2S0_4 pH<2	COD 24 days, TOC 28 days
Water	160.1, 160.2, 310.1, 300.0	Total Suspended Solids, Total Dissolved Solids, Alkalinity, Chloride, Sulfate	Two 500-ml plastic bottles	4° C	TSS 7 days, TDS 7 days, Alkalinity 14 days, Chloride 14 days, Sulfate 28 days
Water	7196	Hexavalent Chromium	One liter amber	4° C	24 hours

*One 16oz glass container filled is sufficient for metals, semivolatile organics, and pesticides & PCB sediment analysis

**One 500-ml bottle is sufficient for total metals, As, Hg, and hardness analysis

FIGURES



LEGEND:

- SOLDIER CREEK AND TRIBUTARIES
- UNDERGROUND PORTION OF CREEK
- BOUNDARY OF TINKER AIR FORCE BASE
- ⊗ SAMPLING LOCATION ON TRIBUTARY B AND QW07
- 1ST QUARTER SAMPLE LOCATION
- 2ND QUARTER SAMPLE LOCATION
- 3RD QUARTER SAMPLE LOCATION
- 4TH QUARTER SAMPLE LOCATION

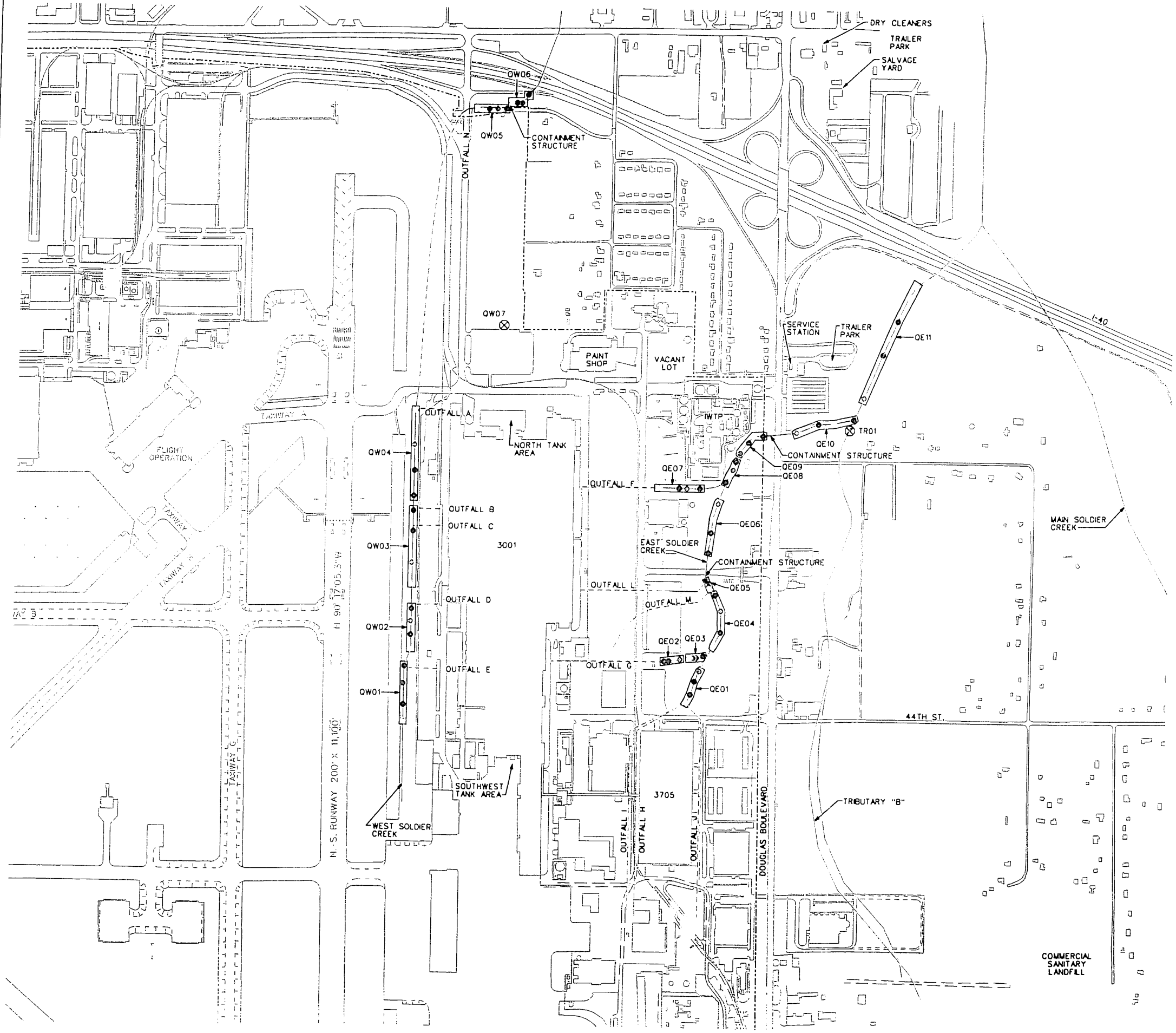
N

800 0 800 1600

SCALE FEET

MCS FILE: SOLDG-01-RF-CTABBI

Designed By: D.D.N.	TINKER AIR FORCE BASE		
Drawn By: T.R.F.	OKLAHOMA CITY, OKLAHOMA		
Checked By: D.J.K	TITLE: SOLDIER CREEK QUARTERLY MONITORING SAMPLING LOCATIONS		
Submitted By:	PROJECT NUMBER F96515	DATE JAN 1997	FIG. NO. 3-1



LEGEND:

- SOLDIER CREEK AND TRIBUTARIES
- UNDERGROUND PORTION OF CREEK
- BOUNDARY OF TINKER AIR FORCE BASE
- ⊗ SAMPLING LOCATIONS ON TRIBUTARY B AND QW07
- 1ST SEMI-ANNUAL MONITORING EVENT SAMPLE LOCATION
- 2nd SEMI-ANNUAL MONITORING EVENT SAMPLE LOCATION
- QUARTERLY SAMPLE LOCATIONS NOT SAMPLED DURING SEMI-ANNUAL MONITORING

N

800 0 800 1600

SCALE FEET

24 OCT 97 08:42:31
k:\tinker\dgn\soldq-11.dgn

Designed By: D.D.N.	TINKER AIR FORCE BASE
Drawn By: J.W.B.	OKLAHOMA CITY, OKLAHOMA
Checked By: D.D.N	TITLE: SEMI-ANNUAL MONITORING SAMPLING LOCATIONS
Submitted By:	PROJECT NUMBER F96526 / DATE OCT. 1997 / FIG. NO. 3-2

4.0
HUMAN HEALTH RISK ASSESSMENTS

An evaluation of risks associated with Soldier Creek surface water and sediments was previously performed by Black & Veatch Waste Science Technology (B&V, 1993). Since the time of the original risk assessment, additional information on the nature and extent of stream contamination has been collected, including additional sediment and surface water sampling, as well as information on pesticides and PCBs not previously evaluated. The Human Health Risk Assessment I (HHRA I) was prepared for the first year of quarterly monitoring to provide information on potential current and future risks based on current surface water and sediment contaminant levels, to compare the results with those of B&V to see if the previous conclusions are still valid, and to develop cleanup goals that are protective of human populations. The HHRA I is presented in its entirety in the Final Quarterly Monitoring Annual Report (WCFS, 1997a). Based on results of the second year of quarterly monitoring the Human Health Risk Assessment II (HHRA II) was prepared to address the same issues as the HHRA I, and to compare current results with those of the HHRA I to see if the previous conclusions were still valid. The HHRA II is presented in its entirety in the Draft Second Year Quarterly Monitoring Annual Report (WCFS, 1997b). Similarly, the HHRA III was based on the results of the third year of monitoring, and is presented in its entirety in Appendix A.

The HHRA III was performed using guidance provided in the Risk Assessment Guidance for Superfund - Part A and Part B, Exposure Factors Handbook, Standard Default Exposure Factors, Dermal Exposure Assessment: Principles and Applications, and EPA Supplemental Region IV Risk Assessment Guidance. Environmental data obtained from surface water and sediment samples collected by Woodward-Clyde in the third year monitoring events (WCFS, 1997d and e) were used in the HHRA III. In addition, the HHRA III made use of recent EPA databases, including the Integrated Risk Information System (IRIS; Health Effects Assessment Summary Tables (HEAST) and EPA Region III Risk-Based Concentration Table. References used in the HHRA III are cited in Appendix A.

The HHRA III utilized the same stream segments and exposure scenarios as the HHRA I and HHRA II. Based on differences in contaminant sources and exposed populations, the following four stream segments were evaluated in this risk assessment:

- West Soldier Creek, on-base
- West Soldier Creek, off-base
- East Soldier Creek, on-base
- East Soldier Creek, off-base

The chemicals of potential concern identified include metals, PCBs, chlorinated pesticides, volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). An evaluation of potential health risks was performed for a group of exposure scenarios believed to represent potential forms of human activities that could occur at these areas. These exposure scenarios include the following:

- Construction workers involved in repair or installation of underground pipelines around or under on-base portions of the creeks

- Residents wading or swimming in the off-base portion of West and East Soldier Creeks. (Swimming was only evaluated for the child scenario for East Soldier Creek; all other scenarios assume wading only)

Potential health risks associated with surface water and sediment exposure were evaluated for both on-site construction workers and off-site residents. The results of the risk characterization indicate that potential cancer risks and non-carcinogenic health hazards for all scenarios are within or below the advisory range of 10^{-6} to 10^{-4} and 1.0, respectively. These results indicate that exposure to surface water and sediments in West and East Soldier Creeks is not likely to result in an unacceptable cancer risk or non-carcinogenic hazard for any on-base or off-base populations under current or future stream use conditions.

The following differences in approaches/assumptions were noted between the HHRAs and Baseline Health Risk Assessment (BHRA):

- The HHRAs evaluated PCBs/chlorinated pesticides as potential COCs. The BHRA prepared by B&V did not include these data

- The individual stream segments, evaluated in the B&V BHRA are not identical to the segments evaluated in the HHRAs (the stream segments evaluated in the HHRAs are thought to be more representative of actual stream use)

- Some of the exposure assumptions used in HHRAs are different than those used in B&V BHRA (e.g., the HHRAs utilized age-corrected surface area for

evaluating exposure to surface water and sediments; B&V BHRA values were not age corrected, which was not required at the time of the BHRA).

The results of the HHRA III were compared to those presented in the HHRA I and HHRA II. The results of the comparison between the three HHRAs showed no dramatic changes. Although the off-base East Soldier Creek cancer risks show a steady decline from HHRA I to HHRA III.

Despite slight differences in approach between the HHRAs and the BHRA, all risk assessments have concluded that there are no unacceptable cancer risks or non-carcinogenic hazards associated with exposure to East or West Soldier Creeks for any on-base or off-base populations, under current of future stream use conditions. Thus no remedial action appears to be warranted based on risks to human health.

As part of the risk assessment, a set of cleanup goals was developed to identify health-protective levels for each COC. Although remediation does not appear to be warranted at the present time (based on risk to human health), these cleanup goals provide a set of "action criteria", should remedial action be required in the future.

5.0
DISCUSSION OF MONITORING RESULTS

This section discusses data screening and evaluation procedures and the results of the third year of sediment and surface water long-term monitoring of the Soldier Creek Operable Unit.

5.1 DATA SCREENING

The purpose of data screening and analysis was to determine which analytes are present and which of those exceed media specific screening criteria. For this assessment, a simple two step procedure was used. The first step was to establish the presence or absence of analytes in the sediment and surface water samples. First, all analytes reported in detectable concentrations were tabulated on a segment by segment basis for each monitoring event.

The second step involved sample by sample comparisons to screening criteria. Screening criteria were set forth in the ROD (B&V, 1993b) and the HHRA I (WCFS, 1997a). These screening criteria are risk-based values to which specific analyte concentrations are compared. If sample concentrations were below the decision criteria, it was assumed that the analyte does not pose an unacceptable risk to human health and response actions are not required. Therefore, the analyte was dropped from further consideration. If screening criteria were exceeded, the analyte was considered a potential COC.

According to the ROD (B&V, 1993b), unacceptable exposures were determined based on the following criteria:

- Contaminant concentrations in sediment or surface water exceeding health levels based on an excess lifetime cancer risk of 10^{-4}. Contaminant concentrations detected in the 10^{-4} to 10^{-6} range may potentially indicate an unacceptable exposure level and will be evaluated to determine if the exposure level was unacceptable and remediation, therefore, necessary.

- Contaminant concentrations in sediment or surface water with non-carcinogenic hazard indices (HIs) greater than 1.0

- Contaminant concentrations in sediment or surface water that present an unacceptable ecological risk

The first two criteria were based on exposure factors developed by the BHRA for human health under the RI/FS, and the HHRA I. Summaries of carcinogenic and non-carcinogenic risks for contaminants of concern in sediment and surface water from the BHRA are presented in Table 5-1 and Table 5-2. Risk based cleanup levels developed by the HHRA I for sediment and surface water are presented in Tables 5-3 through 5-4. The following evaluation and discussion of analytical results is for the third year long-term monitoring results. These results were screened against the BHRA and HHRA I screening criteria as described above. The third year analytical results were also evaluated under the HHRA III for unacceptable cancer risk or non-carcinogenic hazard presented in Appendix A.

5.2 EVALUATION AND DISCUSSION OF RESULTS

5.2.1 Sediment

A total of 74 sediment samples (39 during 1Evnt3Yr and 35 during 2Evnt3Yr) were collected during the third year of long-term monitoring. Sediment samples were generally collected at three intervals from 0-6 inches, 6-12 inches, and 3-5 feet. Samples from TR01 were only collected from 0-6 inches, per the scope of work. When refusal of the sampling device occurred prior to 5 feet bgs, a sample was typically collected from the bottom one foot interval of the boring. The number of sediment samples collected varied each event based on the depth of sediment at each sampling location. In some sampling segments, particularly on-base East Soldier Creek, upstream of Bradley Drive, the stream bed is scoured to bedrock with few, shallow depositional areas.

Appendix B contains tables which summarize the analyte detections by monitoring event. Table 5-5 presents the frequency of detection, maximum, minimum and average concentrations of analytes detected in sediment. Statistical summaries were calculated based on detected concentrations in analytical samples excluding non-detects and QA/QC samples. The sample location at which the maximum concentration of an analyte was detected is presented in Table 5-6. Table 5-7 presents a summary of analytes for 0-6 inches and 6-12 inches bgs for the first three years of long-term monitoring which exceeded the BHRA screening criteria. Analytes which exceeded HHRA I 10^{-5} and 10^{-6} carcinogenic screening

criteria during the first three years of long-term monitoring are presented in Table 5-8 and Table 5-9. No analytes in sediment samples exceeded the HHRA I 10^{-4} carcinogenic screening criteria. One sample exceeded the HHRA I non-carcinogenic screening criteria for Aroclor 1254 as discussed below. Table 5-10 presents a comparison of the maximum analyte concentration for each event of the first three years of long-term monitoring to the maximum RI sampling analytical results.

5.2.1.1 Metals

Twenty-five metals were detected during the third year of monitoring. Metals detected by Methods 6010 were: aluminum, antimony, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, molybdenum, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc. Metals detected by Methods 7060, 7196, and 7471, were arsenic, hexavalent chromium, and mercury, respectively.

The most frequently detected metals and their maximum concentrations were aluminum (22,700 mg/kg), arsenic (15.7 mg/kg), barium (3,200 mg/kg), calcium (141,000 mg/kg), chromium (4,020 mg/kg), cobalt (166), copper (2,010 mg/kg), iron (24,400 mg/kg), lead (934 mg/kg), magnesium (27,100 mg/kg), manganese (7,430 mg/kg), nickel (6,470 mg/kg), potassium (3,520 mg/kg), vanadium (117 mg/kg), and zinc (2,310 mg/kg). These metals were detected in all 74 sediment samples collected during the third year of monitoring. Metals concentrations in sediment did not exceed BHRA or HHRA I screening criteria.

5.2.1.2 PCB's and Chlorinated Pesticides

4,4'-DDD, 4,4'-DDE, aldrin, alpha-chlordane, aroclor 1254, aroclor 1260, dieldrin, endosulfan II, gamma-chlordane, heptaclor, and heptaclor epoxide were detected in the sediments during the third year of monitoring. When pesticides or PCBs were detected in an analytical sample, a second column was run. Analytical results were qualified with "M" (primary result), "d" (see primary result), and no qualifier. Data qualified with "d" were not included in the statistical evaluation (Tables 5-5 and 5-6) and are not included in the review of analytical results.

Pesticides and PCBs were not identified as potential COC in the BHRA (B&V, 1993a). Consequently, screening criteria were not available from the BHRA for evaluation. HHRA I

10^{-6} screening criteria for PCBs and pesticides were not exceeded during the third year of monitoring.

The HHRA I non-carcinogenic screening criteria of 66.2 mg/kg was exceeded by one sample during the third year of monitoring. The highest concentration of aroclor 1254 was 82 mg/kg in sample QW03-902 collected from West Soldier Creek. The sample was collected during 1Evnt3Yr monitoring from 6-12 inches. The average reported concentrations of aroclor 1254 for the third year of monitoring was 7.2 mg/kg. Aroclor 1254 was also the most frequently detected PCB/pesticide compound with 22 detections in sediment samples.

5.2.1.3 Semivolatile Organics

Thirty-four semivolatile organic compounds (SVOCs) were detected during the third year of monitoring. The SVOCs detected during the third year of monitoring are presented in Table 5-5.

The highest semivolatile concentration was fluoranthene (32 mg/kg) which occurred in QE07-901 during the 1Evnt3Yr monitoring. Fluoranthene was detected in 59 analytical samples. The average concentration for fluoranthene during the third year of monitoring was 5.3 mg/kg.

Six semivolatile analytes were identified as potential contaminants of concern by exceeding risk-based screening criteria during the third year of monitoring. Benzidine was identified as a potential contaminant of concern during the first year of monitoring. However, benzidine concentrations did not exceed the screening criteria during the second or third years of monitoring. Indeno(1,2,3-cd)pyrene was identified as a potential contaminant of concern during the second year of monitoring by exceeding HHRA 10^{-6} screening criteria. However, indeno(1,2,3-cd)pyrene concentrations did not exceed screening criteria during the third year of monitoring.

The polyaromatic hydrocarbons (PAHs) benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, and chrysene, exceeded the BHRA screening criteria during both third year monitoring events (Table 5-7). Benzo(a)pyrene exceeded the HHRA 10^{-5} screening in one sample from 1Evnt3Yr monitoring (Table 5-8). Benzo(a)pyrene,

benzo(b)fluoranthene, and dibenz(a,h)anthracene exceeded the HHRA I 10^{-6} screening criteria (Table 5-9).

Benzo(a)anthracene was detected in 48 analytical samples, 16 of which exceeded BHRA 10^{-6} screening criteria of 1.6 mg/kg. Benzo(a)anthracene concentrations did not exceed HHRA I screening criteria. The highest concentration of benzo(a)anthracene was 9.9 mg/kg detected in sample QW05-901, collected from an off-base segment of West Soldier Creek. The sample was collected during 1Evnt3Yr monitoring from 0-6 inches. The average detected concentration of benzo(a)anthracene during the third year of monitoring was 1.95 mg/kg.

Benzo(b)fluoranthene was detected in 51 analytical samples, 17 of which exceeded BHRA 10^{-6} screening criteria of 1.6 mg/kg and 2 of which exceeded HHRA I 10^{-6} screening criteria of 10.575 mg/kg. The highest concentration of benzo(b)fluoranthene was 13 mg/kg detected in sample QE07-901, collected from Outfall F. The sample was collected during 1Evnt3Yr monitoring from 0-6 inches. The average detected concentration of benzo(b)fluoranthene during the third year of monitoring was 2.29 mg/kg.

Benzo(k)fluoranthene was detected in 50 analytical samples, 16 of which exceeded BHRA 10^{-6} screening criteria of 1.6 mg/kg. Benzo(k)fluoranthene concentrations did not exceed HHRA I screening criteria. The highest concentration of benzo(k)fluoranthene was 12 mg/kg detected in sample QE08-1001, collected from the pond on East Soldier Creek. The sample was collected the during 2Evnt3Yr monitoring from 0-6 inches. The average detected concentration of benzo(k)fluoranthene during the third year of quarterly monitoring was 2.08 mg/kg.

Benzo(a)pyrene was detected in 48 analytical samples, 15 of which exceeded BHRA 10^{-6} screening criteria of 1.6 mg/kg, one of which exceeded HHRA I 10^{-5} screening criteria of 10.575 mg/kg, and 19 of which exceeded HHRA I 10^{-6} screening criteria of 1.057 mg/kg. The highest concentration of benzo(a)pyrene was 11 mg/kg detected in sample QE07-901, collected from Outfall F. The sample was collected during 1Evnt3Yr monitoring from 0-6 inches. The average detected concentration of benzo(a)pyrene during the third year of monitoring was 2.06 mg/kg.

Chrysene was detected in 52 analytical samples, 20 of which exceeded BHRA 10^{-6} screening criteria of 1.6 mg/kg. Chrysene concentrations did not exceed HHRA I screening criteria.

The highest concentration of chrysene was 12 mg/kg detected in samples QE07-901, QE08-1001, and QW05-901. The average detected concentrations of chrysene during the third year of monitoring was 2.45 mg/kg.

Dibenz(a,h)anthracene was detected in 25 analytical samples, 6 of which exceeded the HHRA I 10^{-6} screening criteria of 1.057 mg/kg. Dibenz(a,h)anthracene did not exceed BHRA screening criteria. The highest concentration of dibenz(a,h)anthracene was 1.9 mg/kg detected in sample QE07-901, collected from Outfall F. The sample was collected during 1Evnt3Yr monitoring from 0-6 inches. The average detected concentration of dibenz(a,h)anthracene during the third year of monitoring was 0.60 mg/kg.

Figure 5-1 illustrates the sample locations where exceedances of BHRA 10^{-6} screening criteria occurred in 0-6 inch sediment samples, during the third year of monitoring. Figures 5-2a through 5-2p present graphs of temporal PAH concentrations by stream segment for the first three years of monitoring. Graphs are presented for those segments in which exceedance of BHRA PAH screening criteria occurred, and for segments located at the downstream sampling boundaries. The graphs illustrate the sediment concentrations at 0-6 inches for the five PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and chrysene). The graphs illustrate that typically the detected PAH concentrations follow the same trend (e.g., an increase in one PAH compound is associated with increases in the other detected PAH compounds).

The graphs also illustrate that the sampling event with the highest concentration of the PAHs varies between the sampling segments. This relationship suggests that multiple origins for the PAHs could exist. For example, during the second year of monitoring many of the highest PAH concentrations occurred in segment QE03 (Outfall G). However, during the third year of monitoring many of the highest PAH concentrations occurred in segment QE07 (Outfall F).

The following discussion presents a summary of peak discharges, and possible trends in the PAH data observed in Figure 5-2a through 5-2p over the first three years of monitoring:

- QE01 - The highest PAH concentrations occurred during the 1Qtr1Yr, 1Qtr2Yr, and 4Qtr2Yr monitoring events.

- QE02 and QE03 - There are no apparent trends from the first to second year monitoring among quarters. At QE03, PAH concentrations peaked during the 2Qtr2Yr monitoring event. At QE02, two peaks in PAH concentrations occurred, during the 3Qtr1Yr, and 4Qtr2Yr monitoring events. PAH concentrations during the third year of monitoring remained relatively low. Sediments along Outfall G are shallow in most locations. The peaks in location may be also related to the availability of depositional sediments. Although peaks from QE02 and QE03 do not occur during the same monitoring events, peaks may be related to spill events, and the depositional characteristics of each sample location.

- QE04 - The peak concentration of PAHs occurred during the 3Qtr1Yr monitoring event. The peak is not seen in the second or third years of monitoring. Sediments at QE04 consist of large smooth gravel. Depositional sediment is not present in this stream segment. PAH concentrations did not exceed BHRA screening criteria during the third year of monitoring.

- QE05 - A spike in PAH concentrations occurred during the 4Qtr1Yr monitoring events. PAH concentrations did not exceed BHRA screening criteria during the third year of monitoring..

- QE06 - The highest PAH concentrations occurred at the third and fourth quarter sample locations during the first two years of monitoring. During the third year of monitoring, PAH concentrations peaked during the first monitoring event (equivalent to the third quarter location), and decreased during the second monitoring event (fourth quarter location). The concentrations decreased from the first to second year of monitoring, and increased during the third year monitoring. The sediments at these sample locations are highly organic, and the creek is marshy.

- QE07 - PAH concentrations peaked during the 1Qtr2Yr monitoring event. Similarly to QE06, PAH concentrations peaked during the first monitoring event (first quarter location), and decreased during the second monitoring event (third quarter location) during the third year of monitoring. During the third year of monitoring, the highest concentrations of benzo(b)fluoranthene, benzo(a)pyrene, and chrysene were detected in segment QE07 during the 1Evnt3Yr monitoring event.

- QE08 - The highest PAH concentrations occurred at the third quarter sample location during the first two years of monitoring. During the third year of monitoring, the highest concentrations of benzo(k)fluoranthene, and chrysene were detected in segment QE08 during the 2Evnt3Yr monitoring event (third quarter location).

- QE09 - PAH concentrations did not exceed screening criteria until the 2Evnt3Yr monitoring event (third quarter location). The exceedance only occurred for Chrysene.

- QE10 - PAH concentrations only exceeded screening criteria during the 4Qtr1Yr monitoring event. Prior to and since that time, PAH concentrations have been very low.

- QE11 - No exceedances of screening criteria occurred at the downstream sampling boundary.

- QW02 and QW03 - Peak PAH concentrations occurred during the 1Qtr2Yr sampling event.

- QW04 - Peak PAH concentrations occurred during the 3Qtr2Yr monitoring event.

- QW05 - PAH concentrations peaked, and exceeded screening criteria during the 1Qtr1Yr, 3Qtr1Yr, and 1Evnt3Yr (first quarter location) monitoring events. PAH concentrations were very low during the second year of monitoring. During the third year of monitoring, the highest concentrations of benzo(a)anthracene and chrysene were detected in segment QW05 during the 1Evnt3Yr monitoring event.

- QW06 - No exceedances of screening criteria occurred at the downstream sampling boundary.

Figures 5-3a through 5-3j present the upstream to downstream concentration gradient of PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, and chrysene) in 0-6 inch bgs sediment samples by event for East Soldier Creek. Similarly, Figures 5-4 a through 5-4j present the upstream to downstream concentration gradient of PAHs in 0-6 inch bgs sediment samples for West Soldier Creek.

The figures illustrate that concentrations of analytes decrease off-base as compared to on-base. Exceedances of 10^{-6} screening criteria (BHRA and HHRA I) occurred during only one quarter the first year of quarterly monitoring on a off-base portion of East Soldier Creek (QE10). Analytical results from the downstream most segments of both East and West Soldier Creek (QE11, and QW06) did not exceed BHRA or HHRA I screening criteria during any sampling event.

The primary source of release of PAHs to the environment occurs as a result of combustion emissions. Discharges may also occur from spills of fuel oils, gasoline, etc., or from runoff from sources such as roadways, asphalt parking lots, or railroad ties.

5.2.1.4 Volatiles

Sixteen volatile compounds (VOCs) were detected in sediment samples during the third year of monitoring. The VOCs detected during the third year of monitoring are presented in Table 5-5. Volatile concentrations in sediment did not exceed BHRA or HHRA I screening criteria.

The most frequently detected volatile compound was acetone. Acetone was detected in 53 analytical samples with a maximum concentration of 0.26 mg/kg and average concentration of 0.04 mg/kg. The highest concentration of acetone was detected in the sediment sample from QE08-901, collected from the pond on East Soldier Creek. The sample was collected during 1Evnt3Yr monitoring from 0-6 inches.

5.2.1.5 Tentatively Identified Compounds

A total of 509 tentatively identified compounds (TICs) were identified in sediments during the third year of monitoring. TICs are compounds detected during analysis of volatile organic and semivolatile organic compounds and are not target compounds, internal standards, or surrogate standard compounds and whose response is greater than 10% of the nearest internal standard compound. The identity of a TIC must be determined using a mass spectral library search for the best match.

Table B-9 in Appendix B, presents the frequency of detection, minimum, and maximum concentrations for all TICs detected in the sediment. The sample location at which the maximum concentration of a TIC was detected is presented in Table B-10 in Appendix B.

5.2.2 Surface Water

A total of 29 (15 during 1Evnt3Yr and 14 during 2Evnt3Yr) surface water samples were collected during the third year of monitoring. The number of surface water samples varied each event due to the intermittent nature of the streams. Sample locations at segments QW01, QW02, and QW04, and the sample location at Tributary B were dry during both monitoring events. The sample location at QW03 was dry during 2Evnt3Yr monitoring.

Appendix B contains tables which summarize analyte detections by monitoring event. Table 5-11 presents the frequency of detection, maximum, minimum, and average concentrations of analytes detected in surface water samples. Statistical summaries were calculated based on detected concentrations in analytical samples excluding detections in QA/QC samples and non-detects. The sample location at which the maximum concentration of an analyte was detected is presented in Table 5-12. Table 5-13 presents a comparison of maximum analyte concentrations of the surface water samples for each monitoring event of the first three years of monitoring to the maximum RI analytical results.

5.2.2.1 Metals

Twenty-two total metals were detected during the second year of monitoring. Total metals detected in surface water by Method 6010/6020/7060/7196/7740 were: aluminum, antimony, arsenic, barium, cadmium, calcium, chromium, cobalt, copper, hexavalent chromium, iron, lead, magnesium, manganese, molybdenum, nickel, potassium, selenium, silver, sodium, vanadium, and zinc.

The most frequently detected total metals and their maximum concentrations were barium (0.62 mg/L), calcium (72.4 mg/L), chromium (0.045 mg/L), cobalt (0.0018 mg/L), manganese (0.24 mg/L), and nickel (0.052 mg/L). These metals were detected in all 29 surface water samples collected during the third year of monitoring.

The highest total metal concentration was calcium (72.4 mg/L) from sample QE02-901, collected from Outfall G. The sample was collected the during 1Evnt3Yr monitoring. The average concentration of calcium from the third year of monitoring was 47.3 mg/L.

Twenty-one dissolved metals were detected during the third year of monitoring. Dissolved metals detected in surface water by Method 6010/6020 were: aluminum, antimony, barium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, molybdenum, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

The most frequently detected dissolved metals and their maximum concentrations were barium (0.59 mg/L), chromium (0.021 mg/L), and vanadium (0.02 mg/L). These metals were detected in all 29 surface water samples.

The highest dissolved metal concentration was calcium (71.5 mg/L) from sample QE08-1001 collected from the pond, on-base East Soldier Creek. The sample was collected during 2Evnt3Yr monitoring. The average concentration of calcium from the third year of monitoring was 50.86 mg/L.

No total or dissolved metals concentrations exceeded BHRA or HHRA I screening criteria in surface water samples.

5.2.2.2 PCBs and Chlorinated Pesticides

Aroclor 1254 was the only PCB/pesticide detected in surface water during the third year of monitoring. Aroclor 1254 was detected in one surface water sample at QE02-901 (0.58 ug/L), collected from Outfall G. The sample was collected during 1Evnt3Yr monitoring.

PCB and pesticide concentrations did not exceed BHRA or HHRA I risk based screening criteria in surface water.

5.2.2.3 Semivolatiles

Bis(2-Ethylhexyl)phthalate was the only SVOC detected in surface water during the third year of monitoring. Bis(2-Ethylhexyl)phthalate was detected in twelve surface water

samples. The maximum concentration (0.14 mg/L) occurred at QE09-1001. This sample was collected from just upstream of Douglas Boulevard on-base East Soldier Creek during 2Evnt3Yr monitoring.

Semivolatile concentrations in surface water did not exceed BHRA or HHRA I risk based screening criteria.

5.2.2.4 Volatiles

Twelve VOCs were detected in surface water during the third year of monitoring. The VOCs detected during the third year of monitoring are presented in Table 5-11.

The highest VOC concentration was ethanol (0.041 mg/L) detected in sample QE02-901. This sample was collected at Outfall G during 1Evnt3Yr monitoring.

Acetone was the most frequently detected VOC, being reported in 25 surface water samples. The highest concentration of acetone was 0.012 mg/L detected in sample QE02-1001, collected from Outfall G during 2Evnt3Yr monitoring. The average surface water concentration of acetone detected during the third year of monitoring was 0.0049 mg/L.

Volatiles concentrations in surface water did not exceed BHRA or HHRA I risk based screening criteria.

5.2.2.5 Wet Chemistry

Surface water samples were analyzed for the following wet chemistry parameters: alkalinity, chemical oxygen demand, hardness, total dissolved solids, total organic carbon, total suspended solids, chloride, and sulfate. Results of wet chemistry analysis are presented in Table B-7 and Table B-8 in Appendix B.

5.2.2.6 Tentatively Identified Compounds

A total of 64 TICs were identified in surface water during the third year of monitoring. TICs are compounds detected during analysis of volatile organic and semivolatile organic compounds and are not target compounds, internal standards, or surrogate standard compounds and whose response is greater than 10% of the nearest internal standard

compound. The identity of a TIC must be determined using a mass spectral library search for the best match.

Table B-11 in Appendix B, presents the frequency of detection, minimum, and maximum concentrations for the TICs detected in surface water. The sample location at which the maximum concentration of a TIC was detected is presented in Table B-12 in Appendix B.

TABLES

TABLE 5-1
CARCINOGENIC AND NON-CARCINOGENIC
BASELINE HEALTH RISK ASSESSMENT (BHRA) SCREENING CRITERIA FOR SEDIMENT

Compound Name	Non-Caracinogenic	Carcinogenic 10-6	Carcinogenic 10-4
Inorganics (mg/kg)			
Arsenic	2.10E+06		
Mercury	6.20E+05		
Barium	1.40E+08		
Cadmium	1.00E+06		
Chromium	1.00E+07		
Manganese	2.10E+08		
Nickel	4.10E+07		
Silver	6.20E+06		
Vanadium	1.40E+07		
Zinc	4.10E+08		
Semivolatile Organics (ug/kg)			
1,2-Dichlorobenzene	7.90E+08		
1,4-Dichlorobenzene		1.00E+06	1.00E+08
2,4-Dimethylphenol	1.80E+08		
2-Methylphenol	4.40E+08		
3/4-Methylphenol	4.40E+08		
Acenaphthene	3.80E+07		
Anthracene	1.90E+08		
Benzo(a)anthracene		1.60E+03	1.60E+05
Benzo(a)pyrene		1.60E+03	1.60E+05
Benzo(b)fluoranthene		1.60E+03	1.60E+05
Benzo(k)fluoranthene		1.60E+03	1.60E+05
bis(2-Ethylhexyl)^phthalate	1.30E+07	1.00E+05	1.00E+07
Butyl benzyl phthalate	1.30E+08		
Chrysene		1.60E+03	1.60E+05
Dibenz(a,h)anthracene		1.20E+05	1.20E+07
Fluoranthene	2.50E+07		
Fluorene	2.50E+07		
Indeno(1,2,3-cd)pyrene		1.20E+05	1.20E+07
Naphthalene	2.50E+06		
Pyrene	1.90E+07		
Volatile Organics (ug/kg)			
Acetone	4.10E+07		
Benzene		3.30E+04	3.30E+06
Carbon disulfide	5.70E+08		
Chlorobenzene	8.30E+06		
Chloroform	4.10E+06	1.60E+05	1.60E+07
cis-1,2-Dichloroethene			
Ethylbenzene	5.70E+08		
Methylene chloride	2.50E+07	1.30E+05	1.30E+07
Tetrachloroethene	4.10E+06	1.90E+04	1.90E+06
Toluene	8.30E+07		
trans-1,2-Dichloroethene			
Trichloroethene		1.40E+06	1.40E+08
Vinyl acetate	5.70E+09		
Xylenes (total)	8.30E+08		

TABLE 5-2
CARCINOGENIC AND NON-CARCINOGENIC
BASELINE HEALTH RISK ASSESSMENT (BHRA) SCREENING CRITERIA FOR SURFACE WATER

Compound Name	Non-Caracinogenic	Carcinogenic 10-6	Carcinogenic 10-4
Inorganics (mg/L)			
Arsenic	8.10E+00		
Barium	2.50E+02		
Beryllium	1.50E+02		
Cadmium	2.10E+00		
Chromium	1.10E+01		
Manganese	3.50E+02		
Nickel	6.20E+01		
Silver	3.50E+02		
Vanadium	5.60E+02		
Zinc	1.30E+03		
Semivolatile Organics (ug/L)			
Benzoic acid	1.00E+05		
Chrysene		1.20E+03	1.20E+05
Fluoranthene	2.20E+04		
Pyrene	5.90E+06		
Volatile Organics (ug/L)			
1,1,1-Trichloroethane	1.10E+05		
Acetone	5.00E+05		
Benzene		2.00E+01	2.00E+03
Bromodichloromethane	8.40E+05	1.70E+03	1.70E+05
Bromoform	1.90E+06	3.30E+04	3.30E+06
Carbon disulfide	5.30E+03		
Chlorobenzene	1.30E+04		
Chloroform	2.00E+04	7.60E+02	7.60E+04
cis-1,2-Dichloroethene			
Dibromochloromethane	1.30E+06	2.00E+03	2.00E+05
Methylene chloride	1.70E+05	8.90E+02	8.90E+04
Tetrachloroethene	5.70E+04	3.10E+02	3.10E+04
Toluene	5.60E+03		
trans-1,2-Dichloroethene			
Trichloroethene		2.80E+02	2.80E+04
Xylenes (total)	1.10E+07		

TABLE 5-3

CARCINOGENIC AND NON-CARCINOGENIC
HUMAN HEALTH RISK ASSESSMENT I (HHRA I) SCREENING CRITERIA FOR SEDIMENT

Chemical	Reasonable Maximum Exposure (mg/kg)	Total Hazard Quotient	Total Cancer Risk	Non-carcinogenic [a] Action Level (mg/kg)	Carcinogenic [b] Action (Risk = 1 x 10^{-6}) (mg/kg)	Carcinogenic [b] Action (Risk = 1 x 10^{-5}) (mg/kg)	Carcinogenic [b] Action (Risk = 1 x 10^{-4}) (mg/kg)
Inorganics							
Antimony	6.42E+00	3.69E-03		1.74E+03			
Beryllium	5.61E-01	2.58E-05	2.38E-07	2.18E+04	2.36E+00	2.36E+01	2.36E+02
Cadmium	1.23E+02	2.83E-02		4.35E+03			
Chromium	7.64E+02	8.94E-06		1.00E+06[c]			
Cobalt	8.22E+00	3.15E-05		2.61E+05			
Lead	1.62E+02						
Mercury	1.64E-01	1.26E-04		1.31E+03			
Nickel	2.09E+02	2.40E-03		8.71E+04			
Silver	4.95E+00	2.28E-04		2.18E+04			
Thallium	1.09E+00	3.13E-03		3.48E+02			
Vanadium	2.03E+01	6.66E-04		3.05E+04			
Pesticides and PCBs							
Aldrin	4.50E-02	4.53E-04	9.91E-08	9.93E+01	4.54E-01	4.54E+00	4.54E+01
alpha-BHC	2.00E-03		1.63E-09		1.23E+00	1.23E+01	1.23E+02
alpha-Chlordane	7.48E-02	3.77E-04	1.26E-08	1.99E+02	5.94E+00	5.94E+01	5.94E+02
Aroclor 1254	1.70E+00	2.57E-02		6.62E+01			
delta-BHC	1.27E-01						
Heptachlor	9.70E-01	5.86E-04	5.65E-07	1.65E+03	1.72E+00	1.72E+01	1.72E+02
Volatiles							
2-Butanone (MEK)	6.66E-03	3.36E-09		1.00E+06[c]			
Acetone	3.98E-02	1.20E-07		3.31E+05			
Acrylonitrile	4.50E-03	4.53E-05	9.91E-09	9.93E+01	4.54E-01	4.54E+00	4.54E+01
Benzene	5.60E-03		1.68E-12		3.33E+03	3.33E+04	3.33E+05
Carbon disulfide	9.47E-03	2.86E-08		3.31E+05			
Chlorobenzene	7.00E-03	1.06E-07		6.62E+04			
Ethylbenzene	1.30E-02	3.77E-09		1.00E+06[c]			
Methylene chloride	6.95E-03	3.50E-08	6.75E-12	1.99E+05	1.03E+03	1.03E+04	1.03E+05
Tetrachloroethene	5.45E-03	1.58E-08		3.45E+05			
Toluene	2.20E-03	3.32E-09		6.62E+05			
trans-1,2-Dichloroethene	1.50E-03	2.27E-08		6.62E+04			
Trichloroethene	1.07E-02	5.16E-08	1.22E-12	2.07E+05	8.79E+03	8.79E+04	8.79E+05
Vinyl chloride	5.66E-03		1.11E-10		5.09E+01	5.09E+02	5.09E+03
Xylenes (total)	3.25E-02	4.71E-10		1.00E+06[c]			
Semivolatiles							
1,2,4-Trichlorobenzene	4.30E-01	8.25E-07		5.21E+05			
1,2-Dichlorobenzene	5.07E-01	1.63E-07		1.00E+06[c]			
1,3-Dichlorobenzene	2.79E+00	9.08E-07		1.00E+06[c]			
1,4-Dichlorobenzene	2.10E-01		5.21E-11		4.03E+03	4.03E+04	4.03E+05

TAb. . . 5-3

CARCINOGENIC AND NON-CARCINOGENIC HUMAN HEALTH RISK ASSESSMENT I (HHRA I) SCREENING CRITERIA FOR SEDIMENT

Chemical	Reasonable Maximum Exposure (mg/kg)	Total Hazard Quotient	Total Cancer Risk	Non-carcinogenic [a] Action Level (mg/kg)	Carcinogenic [b] Action (Risk = 1 x 10^{-6}) (mg/kg)	Carcinogenic [b] Action (Risk = 1 x 10^{-5}) (mg/kg)	Carcinogenic [b] Action (Risk = 1 x 10^{-4}) (mg/kg)
1-Chloronaphthalene	1.30E+00	1.31E-05		9.93E+04			
2,4-Dimethylphenol	3.50E-01	5.07E-07		6.91E+05			
2-Chloronaphthalene	6.90E-02	2.61E-07		2.65E+05			
2-Methylnaphthalene	1.10E-01	1.11E-06		9.93E+04			
3,4-Methylphenol	1.60E-01	9.67E-07		1.65E+05			
Acenaphthene	2.41E-01	1.21E-06		1.99E+05			
Acenaphthylene	3.90E+00	3.77E-06		1.00E+06[c]			
Anthracene	7.50E-02	7.56E-08		9.93E+05			
Benzidine	1.19E+01	1.15E-04	2.83E-05	1.04E+05	4.20E-01	4.20E+00	4.20E+01
Benzo(a)anthracene	3.23E+00		3.05E-07		1.06E+01	1.06E+02	1.06E+03
Benzo(a)pyrene	1.52E+00		1.43E-06		1.06E+00	1.06E+01	1.06E+02
Benzo(b)fluoranthene	7.61E-01		7.19E-08		1.06E+01	1.06E+02	1.06E+03
Benzo(g,h,i)perylene	6.00E-01	6.04E-06		9.93E+04			
Benzo(k)fluoranthene	5.51E-01		5.21E-09		1.06E+02	1.06E+03	1.06E+04
Benzoic acid	1.70E-01	1.23E-09		1.00E+06[c]			
bis(2-Ethylhexyl)phthalate	4.90E+00		8.89E-09		5.51E+02	5.51E+03	5.51E+04
Butyl benzyl phthalate	3.70E-01	5.36E-08		1.00E+06[c]			
Chrysene	3.70E+00		3.50E-09		1.06E+03	1.06E+04	1.06E+05
Di-n-butyl phthalate	3.40E-02	1.03E-07		3.31E+05			
Di-n-octyl phthalate	7.70E-02	1.16E-06		6.62E+04			
Dibenz(a,h)anthracene	1.70E-01		1.61E-07		1.06E+00	1.06E+01	1.06E+02
Dibenzofuran	2.13E-01	1.61E-05		1.32E+04			
Dimethyl phthalate	4.50E-02	1.36E-09		1.00E+06[c]			
Fluoranthene	5.30E+00	4.00E-05		1.32E+05			
Fluorene	1.71E+00	1.24E-06		1.00E+06[c]			
Indeno(1,2,3-cd)pyrene	5.38E-01		5.09E-08		1.06E+01	1.06E+02	1.06E+03
Naphthalene	4.50E-01	4.34E-07		1.00E+06[c]			
Phenanthrene	7.27E-01	7.32E-06		9.93E+04			
Phenol	6.30E-02	3.17E-08		1.00E+06[c]			
Pyrene	6.40E+00	6.45E-05		9.93E+04			

Note: a). Action level = (Risk Assessment Conc/HQ) x HI where HI = 1.0

b). Action level = (Risk Assessment Conc Cancer risk) x Target cancer Risk

c). Calculated action level is greater than 100% concentration and 100% concentration is assigned as the cleanup goal

TAB___ 5-4

CARCINOGENIC AND NON-CARCINOGENIC HUMAN HEALTH RISK ASSESSMENT I (HHRA I) SCREENING CRITERIA FOR SURFACE WATER

Chemical	Reasonable Maximum Exposure (mg/L)	Total Hazard Quotient	Total Cancer Risk	Non-carcinogenic [(a)] Action Level (mg/L)	Carcinogenic [(b)] Action (Risk = 1 x 10^{-6}) (mg/L)	Carcinogenic [(b)] Action (Risk = 1 x 10^{-5}) (mg/L)	Carcinogenic [(b)] Action (Risk = 1 x 10^{-4}) (mg/L)
Inorganics							
Arsenic	1.40E-03	1.65E-03	3.18E-07	8.50E-01	4.41E-03	4.41E-02	4.41E-01
Cadmium	2.64E-03	1.88E-03		1.40E+00			
Cobalt	5.23E-03	3.10E-05		1.68E+02			
Molybdenum	2.64E-01	1.22E-03		2.16E+02			
Nickel	2.99E-02	5.92E-04		5.06E+01			
Thallium	1.20E-03	5.29E-03		2.27E-01			
Vanadium	6.66E-03	3.46E-04		1.92E+01			
Pesticides and PCBs							
Aldrin	5.36E-05	7.82E-04	1.71E-07	6.85E-02	3.13E-04	3.13E-03	3.13E-02
Volatile Organics							
2-Butanone (MEK)	2.80E-03	3.65E-08		7.67E+04			
Acetone	5.30E-03	1.64E-05		3.23E+02			
Bromoform	2.46E-03	9.64E-07	5.44E-11	2.56E+03	4.53E+01	4.53E+02	4.53E+03
Carbon disulfide	1.00E-03	1.60E-08		6.25E+04			
Chlorobenzene	1.80E-03	7.05E-07		2.56E+03			
Chloroform	1.80E-03	1.41E-06	3.07E-11	1.28E+03	5.86E+01	5.86E+02	5.86E+03
Methylene chloride	1.25E-02	6.44E-05	1.24E-08	1.94E+02	1.00E+00	1.00E+01	1.00E+02
Tetrachloroethene	9.79E-03	7.66E-06		1.28E+03			
Toluene	1.70E-03	6.65E-08		2.56E+04			
Trichloroethene	1.00E-02	1.31E-05	3.09E-10	7.67E+02	3.25E+01	3.25E+02	3.25E+03
Vinyl chloride	1.00E-03		5.31E-09		1.88E-01	1.88E+00	1.88E+01
Semivolatile Organics							
3/4-Methylphenol	1.70E-03	9.66E-06		1.76E+02			
4-Nitrophenol	2.00E-03	3.34E-05		5.99E+01			
Benzoic acid	3.90E-03	7.63E-09		5.11E+05			
Benzyl alcohol	1.70E-03	4.44E-08		3.83E+04			
bis(2-Ethylhexyl)phthalate	3.60E-03	3.10E-04	3.72E-08	1.16E+01	9.67E-02	9.67E-01	9.67E+00
Fluoranthene	1.50E-03	2.94E-07		5.11E+03			
N-Nitroso-di-n-propylamine	1.80E-03		3.67E-07		4.91E-03	4.91E-02	4.91E-01
Phenol	1.40E-03	3.12E-07		4.49E+03			

Note: a). Action level (Risk Assessment Conc HQ) x HI where HI = 1.0

b). Action level (Risk Assessment Conc Cancer risk) x Target cancer Risk

TABLE 5-5
STATISTICAL EVALUATION OF ANALYTES DETECTED IN SEDIMENT SAMPLES
THIRD YEAR LONG-TERM MONITORING

Analyte	Frequency of Detection	Average Result	Maximum Result	Minimum Result
PCBs and Pesticides - Method 8080 (mg/kg)				
4,4'-DDD	3/74	0.0367	0.042	0.031
4,4'-DDE	1/74	0.0085	0.0085	0.0085
Aldrin	3/74	0.0354	0.097	0.0025
alpha-Chlordane	1/74	0.0130	0.013	0.013
Aroclor 1254	22/74	7.2134	82	0.054
Aroclor 1260	1/74	0.6800	0.68	0.68
Dieldrin	1/74	0.0021	0.0021	0.0021
Endosulfan II	4/74	0.0560	0.093	0.0021
gamma-Chlordane	2/74	0.0215	0.023	0.02
Heptachlor	1/74	0.0081	0.0081	0.0081
Heptachlor epoxide	1/74	0.0028	0.0028	0.0028
Semivolatile Organics - Method 8270 (mg/kg)				
1,2-Dichlorobenzene	4/74	0.79	1.6	0.13
1,3-Dichlorobenzene	1/74	0.38	0.38	0.38
1,4-Dichlorobenzene	4/74	0.33	1.1	0.042
1-Chloronaphthalene	6/74	0.11	0.23	0.046
2,4-Dimethylphenol	1/74	0.06	0.064	0.064
2-Chloronaphthalene	8/74	0.21	0.5	0.053
2-Methylnaphthalene	14/74	0.57	4.5	0.048
3-Methylcholanthrene	1/74	0.25	0.25	0.25
Acenaphthene	22/74	0.62	2.2	0.044
Acenaphthylene	1/74	0.04	0.043	0.043
Acetophenone	1/74	0.11	0.11	0.11
Anthracene	28/74	1.05	4.4	0.043
Benzidine	1/74	0.22	0.22	0.22
Benzo(a)anthracene	48/74	1.95	9.9	0.046
Benzo(a)pyrene	48/74	2.06	11	0.05
Benzo(b)fluoranthene	51/74	2.29	13	0.04
Benzo(g,h,i)perylene	49/74	1.09	5.3	0.042
Benzo(k)fluoranthene	50/74	2.08	12	0.039
Benzoic acid	1/74	0.28	0.28	0.28
bis(2-Ethylhexyl)phthalate	53/74	2.99	19	0.047
Butyl benzyl phthalate	2/74	0.49	0.51	0.47
Chrysene	52/74	2.45	12	0.044
Di-n-butyl phthalate	5/74	0.13	0.3	0.044
Di-n-octyl phthalate	2/74	0.58	0.66	0.5
Dibenz(a,h)anthracene	25/74	0.60	1.9	0.057
Dibenz(a,j)acridine	1/74	0.33	0.33	0.33
Dibenzofuran	17/74	0.51	1.5	0.041
Fluoranthene	59/74	5.29	32	0.053
Fluorene	22/74	0.76	2.5	0.053
Indeno(1,2,3-cd)pyrene	46/74	1.16	4.7	0.041

TABLE 5-5
STATISTICAL EVALUATION OF ANALYTES DETECTED IN SEDIMENT SAMPLES
THIRD YEAR LONG-TERM MONITORING

Analyte	Frequency of Detection	Average Result	Maximum Result	Minimum Result
Isophorone	1/74	0.47	0.47	0.47
Naphthalene	18/74	0.98	4	0.046
Phenanthrene	51/74	3.70	21	0.041
Pyrene	57/74	3.61	25	0.054
Total Metals - Methods 6010/7060/7471/7740 (mg/kg)				
Aluminum	74/74	6357	22700	750
Antimony	9/74	6	11.4	3.9
Arsenic	74/74	3	15.7	0.62
Barium	74/74	507	3200	63.2
Beryllium	58/74	1	1.7	0.27
Cadmium	54/74	48	837	0.57
Calcium	74/74	28765	141000	839
Chromium	74/74	318	4020	10.6
Cobalt	74/74	15	166	1.2
Copper	74/74	121	2010	2.5
Iron	74/74	10959	24400	3420
Hexavalent Chromium	1/74	8	8.42	8.42
Lead	74/74	102	934	4.9
Magnesium	74/74	4853	27100	764
Manganese	74/74	571	7430	70.2
Mercury	53/74	0	8.3	0.013
Molybdenum	44/74	16	262	1
Nickel	74/74	234	6470	6.6
Potassium	74/74	855	3520	133
Selenium	16/74	2	10.3	0.51
Silver	53/74	25	725	0.43
Sodium	16/74	252	1090	107
Thallium	27/74	52	127	13.6
Vanadium	74/74	28	117	5.3
Zinc	74/74	189	2310	7.9
Volatile Organics - Method 8260 (mg/kg)				
1,1,2,2-Tetrachloroethane	1/74	0.0027	0.0027	0.0027
1,1-Dichloroethane	1/74	0.0016	0.0016	0.0016
2-Butanone (MEK)	33/74	0.0123	0.048	0.0025
Acetone	53/74	0.0411	0.26	0.0019
Acrylonitrile	1/74	0.0015	0.0015	0.0015
Benzene	1/74	0.0210	0.021	0.021
Carbon disulfide	9/74	0.0043	0.0092	0.0013
Chlorobenzene	20/74	1.0791	18	0.0014
Chloromethane	3/74	0.0109	0.025	0.0038
Ethylbenzene	8/74	0.0115	0.053	0.0013
Methylene chloride	26/74	0.0035	0.021	0.0014
Styrene	11/74	0.0844	0.5	0.0019

TABLE 5-5
STATISTICAL EVALUATION OF ANALYTES DETECTED IN SEDIMENT SAMPLES
THIRD YEAR LONG-TERM MONITORING

Analyte	Frequency of Detection	Average Result	Maximum Result	Minimum Result
Toluene	6/74	0.0150	0.034	0.0015
Trichloroethene	1/74	0.0019	0.0019	0.0019
Vinyl chloride	2/74	0.0021	0.0028	0.0013
Xylenes (total)	4/74	0.0031	0.0061	0.0015

TABLE 5-6
MAXIMUM DETECTED CONCENTRATIONS AND ASSOCIATED SAMPLE LOCATIONS FOR ANALYTES DETECTED IN SEDIMENT SAMPLES THIRD YEAR LONG-TERM MONITORING

Analyte	Result	Client Description	Footnotes	Detection Limit	% Water
PCBs and Pesticides - Method 8080 (mg/kg)					
4,4'-DDD	0.042	SC-QE09-SD-1001	J	0.054	38.7
4,4'-DDE	0.0085	SC-QW03-SD-1001	M	0.0039	16.1
Aldrin	0.097	SC-QE08-SD-1001	M	0.043	60.1
alpha-Chlordane	0.013	SC-QE01-SD-1001	JM	0.015	55.6
Aroclor 1254	82	SC-QW03-SD-902		14	52.5
Aroclor 1260	0.68	SC-QE01-SD-1001		0.3	55.6
Dieldrin	0.0021	SC-QE11-SD-1001	JM	0.0038	12.4
Endosulfan II	0.093	SC-QE06-SD-1001	M	0.056	40.9
gamma-Chlordane	0.023	SC-QE01-SD-1001	M	0.015	55.6
Heptachlor	0.0081	SC-QE07-SD-1003	M	0.0022	22.6
Heptachlor epoxide	0.0028	SC-QW03-SD-1001	M	0.002	16.1
Semivolatile Organics - Method 8270 (mg/kg)					
1,2-Dichlorobenzene	1.6	SC-QW04-SD-903	J	2.7	38.5
1,3-Dichlorobenzene	0.38	SC-QE08-SD-1002	J	1.9	30.9
1,4-Dichlorobenzene	1.1	SC-QE08-SD-1002	J	1.9	30.9
1-Chloronaphthalene	0.23	SC-QE09-SD-902	J	2	19.1
2,4-Dimethylphenol	0.064	SC-QE09-SD-1001	J	0.54	38.7
2-Chloronaphthalene	0.5	SC-QE09-SD-1001	J	0.54	38.7
2-Methylnaphthalene	4.5	SC-QE08-SD-1002		1.9	30.9
3-Methylcholanthrene	0.25	SC-QE08-SD-1001	J	3.3	60.1
Acenaphthene	2.2	SC-QE03-SD-1001		1.6	19.0
Acenaphthylene	0.043	SC-QW03-SD-1001	J	0.39	16.1
Acetophenone	0.11	SC-QE06-SD-1001	J	1.1	40.9
Anthracene	4.4	SC-QE03-SD-1001		1.6	19.0
Benzidine	0.22	SC-QW03-SD-903	J	15	23.9
Benzo(a)anthracene	9.9	SC-QW05-SD-901		2.2	25.0
Benzo(a)pyrene	11	SC-QE07-SD-901		2	17.7
Benzo(b)fluoranthene	13	SC-QE07-SD-901		2	17.7
Benzo(g,h,i)perylene	5.3	SC-QW04-SD-901	J	7.9	58.3
Benzo(k)fluoranthene	12	SC-QE08-SD-1001		1.7	60.1
Benzoic acid	0.28	SC-QE01-SD-1001	J	7.2	55.6
bis(2-Ethylhexyl)phthalate	19	SC-QE06-SD-902		3.1	46.6
bis(2-Ethylhexyl)phthalate	19	SC-QW04-SD-903		2.7	38.5
Butyl benzyl phthalate	0.51	SC-QE08-SD-1001	J	1.7	60.1
Chrysene	12	SC-QE07-SD-901		2	17.7
Chrysene	12	SC-QE08-SD-1001		1.7	60.1
Chrysene	12	SC-QW05-SD-901		2.2	25.0
Di-n-butyl phthalate	0.3	SC-QE06-SD-903	J	2.2	25.8
Di-n-octyl phthalate	0.66	SC-QW05-SD-901	J	2.2	25.0
Dibenz(a,h)anthracene	1.9	SC-QE07-SD-901	J	2	17.7
Dibenz(a,j)acridine	0.33	SC-QE07-SD-901	J	--	17.7

TABLE 5-6
MAXIMUM DETECTED CONCENTRATIONS AND ASSOCIATED SAMPLE LOCATIONS
FOR ANALYTES DETECTED IN SEDIMENT SAMPLES
THIRD YEAR LONG-TERM MONITORING

Analyte	Result	Client Description	Footnotes	Detection Limit	% Water
Dibenzofuran	1.5	SC-QE03-SD-1001	J	1.6	19.0
Fluoranthene	32	SC-QE07-SD-901		2	17.7
Fluorene	2.5	SC-QE03-SD-1001		1.6	19.0
Indeno(1,2,3-cd)pyrene	4.7	SC-QW04-SD-901	J	7.9	58.3
Isophorone	0.47	SC-QE11-SD-1002		0.41	19.6
Naphthalene	4	SC-QE07-SD-1002		0.41	19
Phenanthrene	21	SC-QW05-SD-901		2.2	25.0
Pyrene	25	SC-QW05-SD-901		2.2	25.0
Total Metals - Methods 6010/7060/7471/7740 (mg/kg)					
Aluminum	22700	SC-QW02-SD-901		33.1	69.8
Antimony	11.4	SC-QW04-SD-903		9.8	38.5
Arsenic	15.7	SC-QE03-SD-901		1.8	44.4
Barium	3200	SC-QE11-SD-901		1.2	16.8
Beryllium	1.7	SC-QW02-SD-901		0.66	69.8
Cadmium	837	SC-QE09-SD-1001		0.82	38.7
Calcium	141000	SC-QE10-SD-901		47.6	16.0
Chromium	4020	SC-QW04-SD-903		1.6	38.5
Cobalt	166	SC-QW03-SD-902		2.1	52.5
Copper	2010	SC-QW03-SD-902		4.2	52.5
Iron	24400	SC-QW02-SD-901		33.1	69.8
Hexavalent Chromium	8.42	SC-QW06-SD-901		0.1	
Lead	934	SC-QW04-SD-903		8.1	38.5
Magnesium	27100	SC-QE11-SD-901		24	16.8
Manganese	7430	SC-QW04-SD-903		1.6	38.5
Mercury	8.3	SC-QE02-SD-1001		1.3	26.8
Molybdenum	262	SC-QW03-SD-902		4.2	52.5
Nickel	6470	SC-QW03-SD-902		8.4	52.5
Potassium	3520	SC-QW01-SD-903		592	15.5
Selenium	10.3	SC-QW03-SD-902		2.1	52.5
Silver	725	SC-QW03-SD-902		2.1	52.5
Sodium	1090	SC-QW07-SD-1003		597	16.3
Thallium	127	SC-QW02-SD-901	J	662	69.8
Vanadium	117	SC-QW02-SD-902		1.3	22.5
Zinc	2310	SC-QW03-SD-902		4.2	52.5
Volatile Organics - Method 8260 (mg/kg)					
1,1,2,2-Tetrachloroethane	0.0027	SC-QE02-SD-901	J	0.0059	15.6
1,1-Dichloroethane	0.0016	SC-QE03-SD-1001	J	0.0062	19.0
2-Butanone (MEK)	0.048	SC-QE08-SD-1001	J	0.13	60.1
Acetone	0.26	SC-QE06-SD-901	B	0.029	66.0
Acetone	0.26	SC-QE08-SD-901	B	0.024	59.1
Acrylonitrile	0.0015	SC-QW01-SD-901	J	0.13	21.2
Benzene	0.021	SC-QE08-SD-1001	J	0.063	60.1

TABLE 5-6
MAXIMUM DETECTED CONCENTRATIONS AND ASSOCIATED SAMPLE LOCATIONS FOR ANALYTES DETECTED IN SEDIMENT SAMPLES THIRD YEAR LONG-TERM MONITORING

Analyte	Result	Client Description	Footnotes	Detection Limit	% Water
Carbon disulfide	0.0092	SC-QE02-SD-1001	J	0.017	26.8
Chlorobenzene	18	SC-QE08-SD-1002		0.9	30.9
Chloromethane	0.025	SC-QE06-SD-901	J	0.029	66.0
Ethylbenzene	0.053	SC-QW03-SD-902		0.053	52.5
Methylene chloride	0.021	SC-QE08-SD-1001	J	0.063	60.1
Styrene	0.5	SC-QW04-SD-901		0.06	58.3
Toluene	0.034	SC-QW03-SD-901		0.0076	33.8
Trichloroethene	0.0019	SC-QE03-SD-1001	J	0.0062	19.0
Vinyl chloride	0.0028	SC-QW03-SD-901	J	0.015	33.8
Xylenes (total)	0.0061	SC-QE06-SD-902	J	0.023	46.6

[1] B=Compound is also detected in blank
J=Result is detected below the reporting limit or is an estimated concentration
M=Primary Result

TABLE 5-7

EXCEEDANCES OF BASELINE HEALTH RISK ASSESSMENT 10^{-6} SCREENING CRITERIA

TO A DEPTH OF ONE FOOT

Sample Location	Sampling Interval (ft)	Analyte	10^{-6} Screening Criteria (ug/kg)	1Qtr1Yr Nov 1994 Detections (ug/kg)	2Qtr1Yr Jan 1995 Detections (ug/kg)	3Qtr1Yr April 1995 Detections (ug/kg)	4Qtr1Yr July 1995 Detections (ug/kg)	1Qtr2Yr Oct 1995 Detections (ug/kg)	2Qtr2Yr Mar 1996 Detections (ug/kg)	3Qtr2Yr May 1996 Detections (ug/kg)	4Qtr2Yr Aug 1996 Detections (ug/kg)	1Evnt3Yr Jan 1997 Detections (ug/kg)	2Evnt3Yr Jul 1997 Detections (ug/kg)
QE01	0-0.5	Benzo(a)anthracene	1,600	2,900	1,600	2,000	ND	2,800	640	710	3,300	1,900	430
		Benzo(a)pyrene	1,600	2,200	1,100	2,200	ND	2,400	670	600	3,000	1,500	540
		Benzo(b)fluoranthene	1,600	6,100	2,600	4,000	ND	5,700	1,500	1,000	5,600	1,200	460
		Benzo(k)fluoranthene	1,600	ND	ND	ND	ND	ND	ND	410	ND	1,400	530
		Chrysene	1,600	5,200	1,900	2,200	ND	2,300	980	860	4,100	2,000	680
QE02	0-0.5	Benzo(a)anthracene	1,600	1,100	750	11,000	6,800	530	2,600	8,600	16,000	830	1,600
		Benzo(a)pyrene	1,600	930	720	9,800	6,300	420	3,000	7,300	14,000	870	1,600
		Benzo(b)fluoranthene	1,600	2,100	1,600	ND	6,300	1,700	4,900	12,000	27,000	990	1,700
		Benzo(k)fluoranthene	1,600	ND	ND	15,000	5,500	ND	ND	ND	ND	760	1,400
		Chrysene	1,600	1,100	860	14,000	7,200	800	3,300	8,600	18,000	1,100	2,200
QE02	0.5-1.0	Benzo(a)anthracene	1,600	NS	NS	13,000	NS	NS	NS	46,000	NS	1,600	NS
		Benzo(a)pyrene	1,600	NS	NS	11,000	NS	NS	NS	35,000	NS	1,600	NS
		Benzo(b)fluoranthene	1,600	NS	NS	20,000	NS	NS	NS	43,000	NS	1,800	NS
		Benzo(k)fluoranthene	1,600	NS	NS	ND	NS	NS	NS	23,000	NS	1,100	NS
		Chrysene	1,600	NS	NS	15,000	NS	NS	NS	42,000	NS	1,900	NS
QE03	0-0.5	Benzo(a)anthracene	1,600	130	1,500	7,100	770	15,000	59,000	3,500	13,000	6,200	7,100
		Benzo(a)pyrene	1,600	210	1,300	5,600	750	12,000	45,000	3,000	11,000	7,000	5,900
		Benzo(b)fluoranthene	1,600	430	ND	11,000	1,400	21,000	83,000	5,900	14,000	8,300	6,600
		Benzo(k)fluoranthene	1,600	ND	2,800	ND	ND	ND	ND	ND	7,400	5,100	4,900
		Chrysene	1,600	200	1,800	8,500	1,200	14,000	57,000	3,800	15,000	8,900	7,900
QE03	0.5-1.0	Benzo(a)anthracene	1,600	NS	NS	NS	3,200	NS	NS	6,800	6,300	NS	NS
		Benzo(a)pyrene	1,600	NS	NS	NS	2,800	NS	NS	5,600	6,200	NS	NS
		Benzo(b)fluoranthene	1,600	NS	NS	NS	3,400	NS	NS	11,000	9,300	NS	NS
		Benzo(k)fluoranthene	1,600	NS	NS	NS	2,600	NS	NS	ND	ND	NS	NS
		Chrysene	1,600	NS	NS	NS	3,900	NS	NS	6,600	7,200	NS	NS
QE04	0-0.5	Benzo(a)anthracene	1,600	42	NS	70	39,000	240	ND	ND	ND	520	ND
		Benzo(a)pyrene	1,600	ND	NS	61	26,000	230	ND	ND	ND	470	ND
		Benzo(b)fluoranthene	1,600	140	NS	150	ND	520	ND	ND	ND	490	ND
		Benzo(k)fluoranthene	1,600	ND	NS	ND	39,000	ND	ND	ND	ND	470	ND
		Chrysene	1,600	93	NS	130	35,000	300	ND	ND	ND	730	ND
QE05	0-0.5	Benzo(a)anthracene	1,600	81	680	710	3,600	1,600	1,100	180	530	130	1,200
		Benzo(a)pyrene	1,600	84	690	640	3,200	1,300	910	170	590	150	940
		Benzo(b)fluoranthene	1,600	180	1,600	1,400	3,100	2,200	1,700	360	1,200	180	1,000
		Benzo(k)fluoranthene	1,600	ND	ND	ND	3,400	ND	ND	ND	ND	150	1,300
		Chrysene	1,600	130	870	980	4,400	1,800	1,200	240	810	230	1,300
QE06	0-0.5	Benzo(a)anthracene	1,600	1,100	130	8,100	8,200	1,700	2,200	2,200	3,900	5,400	1,500
		Benzo(a)pyrene	1,600	920	100	7,400	8,800	1,500	1,900	2,100	3,300	6,800	1,400
		Benzo(b)fluoranthene	1,600	2,000	300	10,000	9,800	2,800	3,700	4,200	6,900	8,800	2,100
		Benzo(k)fluoranthene	1,600	ND	ND	4,700	9,300	ND	ND	ND	ND	7,000	2,000
		Chrysene	1,600	1,200	200	9,300	11,000	1,900	2,700	2,600	5,300	9,300	2,200

TABLE 5-7

EXCEEDANCES OF BASELINE HEALTH RISK ASSESSMENT 10^{-6} SCREENING CRITERIA

TO A DEPTH OF ONE FOOT

Sample Location	Sampling Interval (ft)	Analyte	10^{-6} Screening Criteria (ug/kg)	1Qtr1Yr Nov 1994 Detections (ug/kg)	2Qtr1Yr Jan 1995 Detections (ug/kg)	3Qtr1Yr April 1995 Detections (ug/kg)	4Qtr1Yr July 1995 Detections (ug/kg)	1Qtr2Yr Oct 1995 Detections (ug/kg)	2Qtr2Yr Mar 1996 Detections (ug/kg)	3Qtr2Yr May 1996 Detections (ug/kg)	4Qtr2Yr Aug 1996 Detections (ug/kg)	1Evnt3Yr Jan 1997 Detections (ug/kg)	2Evnt3Yr Jul 1997 Detections (ug/kg)
QE06	0.5-1.0	Benzo(a)anthracene	1,600	15,000	1,300	4,900	830	1,300	1,300	1,100	1,600	2,900	1,300
		Benzo(a)pyrene	1,600	14,000	1,200	6,000	1,200	1,100	1,500	1,000	1,500	ND	1,500
		Benzo(b)fluoranthene	1,600	28,000	2,100	11,000	1,800	ND	2,600	2,000	3,300	2,900	2,300
		Benzo(k)fluoranthene	1,600	ND	ND	ND	ND	2,100	ND	ND	ND	2,800	1,800
		Chrysene	1,600	19,000	1,300	6,600	1,300	1,400	1,800	1,300	2,200	4,000	2,300
QE07	0-0.5	Benzo(a)anthracene	1,600	1,100	2,000	2,300	720	26,000	2,100	1,000	880	9,100	540
		Benzo(a)pyrene	1,600	830	2,200	2,200	670	26,000	2,100	1,000	720	11,000	540
		Benzo(b)fluoranthene	1,600	1,600	3,900	3,800	1,300	49,000	4,000	2,000	1,400	13,000	610
		Benzo(k)fluoranthene	1,600	ND	ND	ND	ND	ND	ND	ND	ND	8,600	490
		Chrysene	1,600	1,200	2,000	2,200	1,000	33,000	2,700	1,400	1,000	12,000	760
QE07	0.5-1.0	Benzo(a)anthracene	1,600	1,600	3,000	4,000	NS	21,000	6,200	1,300	NS	4,700	1,700
		Benzo(a)pyrene	1,600	1,400	2,700	2,600	NS	19,000	4,700	1,400	NS	5,000	1,900
		Benzo(b)fluoranthene	1,600	2,600	4,900	4,500	NS	33,000	8,300	2,800	NS	5,900	1,500
		Benzo(k)fluoranthene	1,600	ND	ND	ND	NS	ND	ND	ND	NS	4,800	2,000
		Chrysene	1,600	1,800	3,300	3,300	NS	21,000	5,900	1,800	NS	6,300	2,100
QE08	0-0.5	Benzo(a)anthracene	1,600	2,200	2,100	11,000	1,900	3,100	4,600	11,000	1,000	7,300	6,900
		Benzo(a)pyrene	1,600	2,200	1,800	7,700	1,700	3,000	5,000	10,000	1,000	7,300	9,300
		Benzo(b)fluoranthene	1,600	4,400	4,000	19,000	3,300	6,500	9,600	20,000	2,000	9,600	11,000
		Benzo(k)fluoranthene	1,600	ND	ND	ND	ND	ND	ND	ND	ND	5,900	12,000
		Chrysene	1,600	2,800	2,600	15,000	2,700	4,300	5,700	12,000	1,500	9,200	12,000
QE08	0.5-1.0	Benzo(a)anthracene	1,600	1,300	270	ND	990	1,900	380	1,300	5,600	290	330
		Benzo(a)pyrene	1,600	1,700	240	ND	ND	1,800	370	1,100	4,100	310	310
		Benzo(b)fluoranthene	1,600	3,500	520	350	1,600	2,400	600	2,200	7,300	340	370
		Benzo(k)fluoranthene	1,600	ND	ND	ND	ND	1	250	ND	ND	280	300
		Chrysene	1,600	2,100	350	280	1,600	2,800	500	1,800	6,500	440	630
QE09	0-0.5	Chrysene	1,600	380	ND	1,100	780	150	530	120	ND	160	1,700
QE10	0-0.5	Benzo(a)anthracene	1,600	ND	NS	ND	1,500	45	NS	ND	ND	ND	ND
		Benzo(a)pyrene	1,600	ND	NS	ND	1,300	47	NS	ND	ND	ND	ND
		Benzo(b)fluoranthene	1,600	ND	NS	ND	2,300	94	NS	ND	ND	ND	ND
		Benzo(k)fluoranthene	1,600	ND	NS	ND	ND	ND	NS	ND	ND	ND	ND
		Chrysene	1,600	ND	NS	ND	2,100	86	NS	ND	ND	ND	ND
QW02	0-0.5	Benzo(a)anthracene	1,600	560	600	360	1,900	2,200	72	870	740	1,300	ND
		Benzo(a)pyrene	1,600	660	700	430	1,400	1,900	91	960	1,000	1,700	55
		Benzo(b)fluoranthene	1,600	760	1,400	810	2,700	ND	180	1,900	1,400	1,900	52
		Benzo(k)fluoranthene	1,600	690	ND	ND	ND	ND	ND	ND	910	2,400	53
		Chrysene	1,600	850	730	520	2,200	2,700	96	1,000	1,200	1,700	68
QW02	0.5-1.0	Benzo(a)anthracene	1,600	120	250	360	2,400	ND	ND	97	NS	ND	ND
		Benzo(a)pyrene	1,600	130	300	440	3,100	46	ND	96	NS	ND	ND
		Benzo(b)fluoranthene	1,600	130	580	790	4,600	ND	77	180	NS	ND	ND
		Benzo(k)fluoranthene	1,600	130	ND	ND	2,200	ND	ND	ND	NS	ND	ND
		Chrysene	1,600	160	330	440	3,900	ND	ND	110	NS	ND	ND

TABLE 5-7

EXCEEDANCES OF BASELINE HEALTH RISK ASSESSMENT 10^{-6} SCREENING CRITERIA

TO A DEPTH OF ONE FOOT

Sample Location	Sampling Interval (ft)	Analyte	10^{-6} Screening Criteria (ug/kg)	1Qtr1Yr Nov 1994 Detections (ug/kg)	2Qtr1Yr Jan 1995 Detections (ug/kg)	3Qtr1Yr April 1995 Detections (ug/kg)	4Qtr1Yr July 1995 Detections (ug/kg)	1Qtr2Yr Oct 1995 Detections (ug/kg)	2Qtr2Yr Mar 1996 Detections (ug/kg)	3Qtr2Yr May 1996 Detections (ug/kg)	4Qtr2Yr Aug 1996 Detections (ug/kg)	1Evnt3Yr Jan 1997 Detections (ug/kg)	2Evnt3Yr Jul 1997 Detections (ug/kg)
QW03	0-0.5	Benzo(a)anthracene	1,600	110	980	ND	440	1,600	610	530	480	260	330
		Benzo(a)pyrene	1,600	ND	1,600	1,100	470	2,100	880	660	780	350	450
		Benzo(b)fluoranthene	1,600	160	3,000	2,000	860	3,700	1,900	1,300	820	320	620
		Benzo(k)fluoranthene	1,600	ND	ND	ND	ND	ND	ND	ND	850	570	390
		Chrysene	1,600	190	1,700	1,100	510	2,500	910	740	720	390	470
QW03	0.5-1.0	Benzo(a)anthracene	1,600	NS	44	43	360	ND	700	230	230	1,600	86
		Benzo(a)pyrene	1,600	NS	66	ND	340	ND	930	310	370	1,800	98
		Benzo(b)fluoranthene	1,600	NS	ND	ND	65	180	1,700	650	440	2,200	120
		Benzo(k)fluoranthene	1,600	NS	110	81	ND	ND	ND	ND	320	2,300	100
		Chrysene	1,600	NS	67	42	400	ND	1,100	340	340	2,100	130
QW04	0-0.5	Benzo(a)anthracene	1,600	2,700	730	1,000	260	520	130	3,400	1,900	1,900	110
		Benzo(a)pyrene	1,600	2,600	1,100	1,300	300	480	200	3,600	2,200	5,200	120
		Benzo(b)fluoranthene	1,600	2,600	2,100	ND	650	790	350	7,000	2,600	4,200	110
		Benzo(k)fluoranthene	1,600	2,400	ND	2,400	ND	ND	ND	ND	2,100	4,100	120
		Chrysene	1,600	3,000	1,200	1,200	390	630	190	4,100	2,700	2,500	150
QW04	0.5-1.0	Benzo(a)anthracene	1,600	1,100	2,500	1,200	2,400	350	120	1,100	89	4,700	97
		Benzo(a)pyrene	1,600	1,500	3,100	1,300	3,200	380	210	1,000	98	4,600	120
		Benzo(b)fluoranthene	1,600	2,200	6,000	2,200	6,600	ND	390	1,800	120	5,600	120
		Benzo(k)fluoranthene	1,600	ND	ND	ND	ND	800	ND	ND	93	5,500	140
		Chrysene	1,600	1,500	3,100	1,100	5,000	450	190	1,200	120	6,100	170
QW05	0-0.5	Benzo(a)anthracene	1,600	360	ND	3,500	ND	ND	ND	ND	ND	9,900	ND
		Benzo(a)pyrene	1,600	430	ND	2,100	ND	ND	ND	ND	ND	7,900	ND
		Benzo(b)fluoranthene	1,600	920	48	ND	65	40	50	67	ND	9,400	ND
		Benzo(k)fluoranthene	1,600	ND	ND	5,300	ND	ND	ND	ND	ND	8,300	ND
		Chrysene	1,600	1,100	ND	3,700	51	ND	ND	ND	ND	12,000	ND

Notes:

NS - No sample obtained during the monitoring event

ND - Non-detect

Shading indicates exceedance of the BHRA 10-6 screening criteria

TABLE 5-8

EXCEEDANCES OF HUMAN HEALTH RISK ASSESSMENT 10^{-5} SCREENING CRITERIA

Sample Location	Sampling Interval (ft)	Analyte	10^{-5} Screening Criteria (ug/kg)	1Qtr1Yr Nov 1994 Detections (ug/kg)	2Qtr1Yr Jan 1995 Detections (ug/kg)	3Qtr1Yr April 1995 Detections (ug/kg)	4Qtr1Yr July 1995 Detections (ug/kg)	1Qtr2Yr Oct 1995 Detections (ug/kg)	2Qtr2Yr Mar 1996 Detections (ug/kg)	3Qtr2Yr May 1996 Detections (ug/kg)	4Qtr2Yr Aug 1996 Detections (ug/kg)	1Evnt3Yr Jan 1997 Detections (ug/kg)	2Evnt3Yr Jul 1997 Detections (ug/kg)
QE02	0.5-1.0	Benzo(a)pyrene	10,575	NS	NS	11000	NS	NS	NS	35000	NS	1600	NS
QE03	0-0.5	Benzo(a)pyrene	10,575	NS	NS	11000	NS	12000	45000	3000	11000	7000	5900
QE04	0-0.5	Benzo(a)pyrene	10,575	ND	NS	61	26000	230	ND	ND	ND	470	ND
QE06	0.5-1.0	Benzo(a)pyrene	10,575	14000	1200	6000	1200	1100	1500	1000	1500	ND	1500
QE07	0-0.5	Heptachlor	17,156	120	1200	ND	52000	7000	630	320	ND	ND	ND
		Benzo(a)-pyrene	10,575	830	2200	2200	670	26000	2100	1000	720	11000	540
QE07	0.5-1.0	Benzo(a)-pyrene	10,575	1400	2700	2600	NS	19000	4700	1400	NS	5000	1900

Notes:

NS - No sample obtained during the monitoring event

ND - Non-detect

Shading indicates exceedance of the HHRA 10^{-5} screening criteria

TABLE 5-9

EXCEEDANCES OF HUMAN HEALTH RISK ASSESSMENT 10 ⁻⁶ SCREENING CRITERIA

Sample Location	Sampling Interval (ft)	Analyte	10 ⁻⁶ Screening Criteria (ug/kg)	1Qtr1Yr Nov 1994 Detections (ug/kg)	2Qtr1Yr Jan 1995 Detections (ug/kg)	3Qtr1Yr April 1995 Detections (ug/kg)	4Qtr1Yr July 1995 Detections (ug/kg)	1Qtr2Yr Oct 1995 Detections (ug/kg)	2Qtr2Yr Mar 1996 Detections (ug/kg)	3Qtr2Yr May 1996 Detections (ug/kg)	4Qtr2Yr Aug 1996 Detections (ug/kg)	1Evnt3Yr Jan 1997 Detections (ug/kg)	2Evnt3Yr Jul 1997 Detections (ug/kg)
QE01	0-0.5	Benzo(a)pyrene	1,057	2200	1100	2200	ND	2,400	670	600	3,000	1,500	540
QE02	0-0.5	Benzo(a)anthracene	10,575	1100	750	11000	6800	530	2,600	8,600	16,000	830	1,600
		Benzo(a)pyrene	1,057	930	720	9800	6300	420	3,000	7,300	14,000	870	1,600
		Benzo(b)fluoranthene	10,575	2100	1600	ND	6300	1,700	4,900	12,000	27,000	990	1,700
		Dibenz(a,h)anthracene	1,057	ND	ND	1500	1600	ND	420	970	ND	ND	ND
		Aldrin	454	ND	ND	ND	1600	810	ND	ND	ND	ND	ND
QE02	0.5-1.0	Benzo(a)anthracene	10,575	NS	NS	13000	NS	NS	NS	46,000	NS	1,600	NS
		Benzo(a)pyrene	1,057	NS	NS	11000	NS	NS	NS	35,000	NS	1,600	NS
		Benzo(b)fluoranthene	10,575	NS	NS	20000	NS	NS	NS	43,000	NS	1,800	NS
		Dibenz(a,h)anthracene	1,057	NS	NS	1300	NS	NS	NS	4,100	NS	270	NS
		Indeno(1,2,3-cd)pyrene	10,575	NS	NS	5600	NS	NS	NS	15,000	NS	790	NS
QE03	0-0.5	Benzo(a)anthracene	10,575	130	1500	7100	770	15,000	59,000	3,500	13,000	6,200	7,100
		Benzo(a)pyrene	1,057	210	1300	5600	750	12,000	45,000	3,000	11,000	7,000	5,900
		Benzo(b)fluoranthene	10,575	430	ND	11000	1400	21,000	83,000	5,900	14,000	8,300	6,600
		Dibenz(a,h)anthracene	1,057	ND	ND	690	ND	1,300	6,000	460	ND	1,300	ND
		Indeno(1,2,3-cd)pyrene	10,575	ND	ND	2600	470	5,100	20,000	1,700	6,100	4,000	2,300
QE03	0.5-1.0	Benzo(a)pyrene	1,057	NS	NS	NS	2800	NS	NS	5,600	6,200	NS	NS
		Benzo(b)fluoranthene	10,575	NS	NS	NS	3400	NS	NS	11,000	9,300	NS	NS
QE04	0-0.5	Benzo(a)pyrene	1,057	ND	NS	61	26000	230	ND	ND	ND	470	ND
		Benzo(a)anthracene	10,575	42	NS	70	39000	240	ND	ND	ND	520	ND
		Dibenz(a,h)anthracene	1,057	ND	NS	ND	10000	ND	ND	ND	ND	120	ND
		Indeno(1,2,3-cd)pyrene	10,575	ND	NS	ND	19000	89	ND	ND	ND	300	ND
QE05	0-0.5	Benzo(a)pyrene	1,057	84	690	640	3200	1,300	910	170	590	150	940
QE06	0-0.5	Benzo(a)pyrene	1,057	920	100	7400	8800	1,500	1,900	2,100	3,300	6,800	1,400
		Dibenz(a,h)anthracene	1,057	ND	ND	1100	2200	170	350	290	ND	1,500	ND
QE06	0.5-1.0	Benzo(a)anthracene	10,575	15000	1300	4900	830	1,300	1,300	1,100	1,600	2,900	1,300
		Benzo(a)pyrene	1,057	14000	1200	6000	1200	1,100	1,500	1,000	1,500	ND	1,500
		Benzo(b)fluoranthene	10,575	28000	2100	11000	1800	ND	2,600	2,000	3,300	2,900	2,300
QE06	1-1	Benzo(a)pyrene	1,057	3100	850	NS	920	NS	1,800	560	830	1,600	NS

TABLE 5-9

EXCEEDANCES OF HUMAN HEALTH RISK ASSESSMENT 10^{-6} SCREENING CRITERIA

Sample Location	Sampling Interval (ft)	Analyte	10^{-6} Screening Criteria (ug/kg)	1Qtr1Yr Nov 1994 Detections (ug/kg)	2Qtr1Yr Jan 1995 Detections (ug/kg)	3Qtr1Yr April 1995 Detections (ug/kg)	4Qtr1Yr July 1995 Detections (ug/kg)	1Qtr2Yr Oct 1995 Detections (ug/kg)	2Qtr2Yr Mar 1996 Detections (ug/kg)	3Qtr2Yr May 1996 Detections (ug/kg)	4Qtr2Yr Aug 1996 Detections (ug/kg)	1Evnt3Yr Jan 1997 Detections (ug/kg)	2Evnt3Yr Jul 1997 Detections (ug/kg)
QE07	0-0.5	Aldrin	454	57	ND	840	ND	3,700	ND	ND	ND	ND	ND
		alpha-Chlordane	5,939	ND	ND	ND	ND	16,000	480	ND	ND	ND	ND
		Benzo(a)anthracene	10,575	1100	2000	2300	720	26,000	2,100	1,000	880	9,100	840
		Benzo(a)pyrene	1,057	830	2200	2200	670	26,000	2,100	1,000	720	11,000	540
		Benzo(b)fluoranthene	10,575	1600	3900	3800	1300	49,000	4,000	2,000	1,400	13,000	610
		Dibenz(a,h)anthracene	1,057	54	ND	260	130	ND	330	130	73	1,900	150
		Heptachlor	1,715	120	1200	ND	52000	7,000	600	310	ND	ND	ND
		Indeno(1,2,3-cd)pyrene	10,575	440	1000	1200	420	14,000	1,100	510	250	4,600	340
QE07	0.5-1.0	Aldrin	454	ND	ND	650	NS	2,500	ND	ND	NS	ND	ND
		alpha-Chlordane	5,939	ND	ND	ND	NS	15,000	250	98	NS	ND	ND
		Benzo(a)anthracene	10,575	1600	3000	4000	NS	21,000	6,200	1,300	NS	4,700	1,700
		Benzo(a)pyrene	1,057	1400	2700	2600	NS	19,000	4,700	1,400	NS	5,000	1,900
		Benzo(b)fluoranthene	10,575	2600	4900	5500	NS	33,000	8,300	2,800	NS	5,900	1,500
		Dibenz(a,h)anthracene	1,057	160	ND	140	NS	2,100	570	190	NS	900	360
		Heptachlor	1,715	820	1400	ND	NS	4,600	390	140	NS	ND	ND
QE07	>1	Benzo(a)pyrene	1,057	2600	NS	270	NS	1,200	NS	ND	NS	54	ND
QE08	0-0.5	Benzo(a)anthracene	10,575	2200	2100	11000	1900	3,100	4,600	11,000	1,000	7,300	6,900
		Benzo(a)pyrene	1,057	2200	1800	7700	1700	3,000	5,000	10,000	1,000	7,300	9,300
		Benzo(b)fluoranthene	10,575	4400	4000	19000	3300	6,500	9,600	20,000	2,000	9,600	11,000
		Dibenz(a,h)anthracene	1,057	54	ND	1600	ND	ND	770	1,100	ND	1,600	1,500
QE08	0.5-1.0	Benzo(a)pyrene	1,057	1700	240	ND	ND	1,800	370	1,100	4,100	310	310
QE09	0-0.5	Benzo(a)pyrene	1,057	830	ND	890	550	87	340	83	ND	130	1,300
QE09	>1	Heptachlor	1,715	ND	36	ND	3100	8	21	ND	ND	ND	NS
QE10	0-0.5	Benzo(a)pyrene	1,057	ND	NS	ND	1300	47	NS	ND	ND	ND	ND
QW02	0-0.5	Benzo(a)pyrene	1,057	660	700	430	1400	1,900	91	960	1,000	1,700	55
QW02	0.5-1.0	Benzo(a)pyrene	1,057	130	300	440	3100	46	ND	96	NS	ND	ND
QW03	0-0.5	Benzo(a)pyrene	1,057	ND	1600	1100	470	2,100	880	660	780	350	450
QW03	0.5-1.0	Benzidine	420	NS	430	ND	ND	ND	ND	ND	ND	ND	ND
QW04	0-0.5	Benzo(a)pyrene	1,057	2600	1100	1300	300	480	200	3,600	2,200	5,200	120
		Dibenz(a,h)anthracene	1,057	750	150	220	ND	60	ND	590	770	1,600	ND

TABLE 5-9

EXCEEDANCES OF HUMAN HEALTH RISK ASSESSMENT 10^{-6} SCREENING CRITERIA

Sample Location	Sampling Interval (ft)	Analyte	10^{-6} Screening Criteria (ug/kg)	1Qtr1Yr Nov 1994 Detections (ug/kg)	2Qtr1Yr Jan 1995 Detections (ug/kg)	3Qtr1Yr April 1995 Detections (ug/kg)	4Qtr1Yr July 1995 Detections (ug/kg)	1Qtr2Yr Oct 1995 Detections (ug/kg)	2Qtr2Yr Mar 1996 Detections (ug/kg)	3Qtr2Yr May 1996 Detections (ug/kg)	4Qtr2Yr Aug 1996 Detections (ug/kg)	1Evnt3Yr Jan 1997 Detections (ug/kg)	2Evnt3Yr Jul 1997 Detections (ug/kg)
QW04	0.5-1.0	Benzo(a)pyrene	1,057	1500	3100	1300	3200	380	210	1,000	98	4,600	120
QW04	1	Benzo(a)pyrene	1,057	580	NS	3100	3200	1,900	370	330	53	5,800	84
QW05	0.0.5	Benzo(a)pyrene	1,057	430	ND	2100	ND	ND	ND	ND	ND	7,900	ND

Notes:

NS - No sample obtained during the monitoring event

ND - Non-detect

Shading indicates exceedance of the HHRA 10^{-6} screening criteria

TABLE 5-10
COMPARISON OF LONG-TERM MONITORING MAXIMUM ANALYTE CONCENTRATIONS WITH RI RESULTS IN SEDIMENT

Analytes	Phase I RI	Phase II RI	1qtr1yr (Nov 1994)		2qtr1yr (Jan 1995)		3qtr1yr (Apr 1995)		4qtr1yr (Jul 1995)		1qtr2yr (Oct 95)		2qtr2yr (Mar 96)		3qtr2yr (May 96)		4qtr2yr (Aug 96)		1Evnt3Yr (Jul 97)		2Evnt3Yr (Jan 97)	
			0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in
Metals (mg/kg)																						
Aluminum	42300		14100	16400	23400	20000	21000	16400	13400	12900	21000	21200	17000	9490	16700	15400	23400	13500	22700	13800	12000	8940
Antimony					9.8	6.2	7.9	9.5	8.6		15.8	5.6			7.9		17.3				7.6	6.2
Arsenic	15.7		7.5	7.5	7.2	5.3	8.4	7.2	9	5.7	5.2	8.7	10.5	3.2	6.4	6.1	13.2	7.3	15.7	7.2	5.3	4.8
Barium	2910		3850	1010	2380	1350	1860	12000	1690	1050	3350	807	2440	620	1330	1270	1840	2010	3200	1790	2370	655
Beryllium			1.1	1.3	1.2	1.2	1.5	1.2	0.85	0.82	1.2	1.4	1.2	0.72	1	0.78	1.5	0.97	1.7	0.81	0.97	0.93
Boron																						
Cadmium	428	15.7	123	328	83.2	132	106	183	415	108	87.3	306	85.1	120	390	158	242	29.8	80	112	837	255
Calcium	72500		181000	132000	128000	36000	142000	81200	210000	174000	214000	107000	231000	54700	140000	94300	79200	76800	141000	121000	79300	67800
Chromium	2020	186	820	13350	1230	2430	1890	828	2040	3210	912	5140	2920	977	2230	1460	1870	1850	2800	1110	1700	1210
Cobalt	52.1		42.1	35.7	123	91.8	61.7	56.7	21.6	126	108	105	51.8	80.4	109	20.1	90.1	15.1	61.7	166	36.6	16.4
Copper	600		541	168	650	125	583	246	2210	175	654	1220	551	181	467	217	17000	292	581	2010	548	401
Iron	41200		19000	26600	249000	19800	21100	21800	24900	22200	24900	27900	26700	15500	20200	17800	27500	31800	24400	18500	15300	20300
Lead	586	152	318	184	225	469	268	286	4400	746	498	616	291	187	1050	170	1210	224	528	422	415	160
Magnesium	20400		22800	15200	16700	12000	13600	10300	306000	17000	24100	13100	12400	9590	17300	15000	6120	9150	27100	22000	23900	7320
Manganese	1490		890	965	836	1750	778	2030	1930	4250	1730	1130	857	653	4140	853	1840	2940	1780	1890	1830	725
Mercury	2.6		0.55	0.3	.9	.3	.59	.81	0.63	0.58	1.5	1.1	4.7	0.5	0.9	0.67	3.8	0.67	3.7	0.55	8.3	0.41
Molybdenum			23.8	26	62.6	34.8	36.9	56.4	25.5	17.9	39.4	136	135	28	32.6	21	62.1	27.7	41.8	262	14.5	7.7
Nickel	2270		704	1090	3160	1370	2830	1220	747	861	3690	8790	3600	1790	778	431	1420	801	1430	6470	180	480
Potassium	2300		2030	2910	4230	4880	3200	2850	1930	1590	2830	2820	2780	1380	2530	2450	3010	2400	2730	2050	1430	1400
Selenium	10.2		3.4	4.2	12	2	4.3	.79	1	0.85	7.2	17.7	6.2	1.3	0.93	0.54	7.2	5.5	7.5	10.3	2.1	1.9
Silver	112		64.6	79.4	205	72.2	91.9	6.9	18.7	15.9	112	245	131	80	102	19.1	42.7	2.3	99.2	725	15.2	14.8
Sodium			1890	819					191	165	400	392			270	296					242	517
Thallium			0.38	0.19			.2		0.14	0.18	0.33	0.26			62.6	51.4	61.6	52.5	127	126	37.8	36.5
Tin																						
Vanadium	52.9		48.7	58.7	95.7	42.1	67.9	38.4	48.3	47	75.4	112	121	48.7	46.3	31.7	57	56.8	82.9	117	45.8	36
Zinc	640		668	372	1790	506	1280	311	890	542	1920	2570	1670	557	442	209	759	227	1180	2310	671	268
PCB's and Chlorinated Pesticides (mg/kg)																						
4,4'-DDD											260		890		72	63					0.042	0.037
4,4'-DDE																					0.0085	
4,4'-DDT																						
Aldrin			57	120		1.4	840	650			3700	2500							0.0067		0.097	
alpha-BHC							2															
alpha-Chlordane				910							16000	15000	480	250	120	98					0.013	
Aroclor 1016																						
Aroclor 1221																						
Aroclor 1232																						
Aroclor 1242																						
Aroclor 1248																						
Aroclor 1254			8300	5200	24000	33000	40000	18000	25000	17000	39000	19000	15000	86000	20000	51000	61000	8200	10	82	3.6	0.24
Aroclor 1260																	480				0.68	
beta-BHC																						
delta-BHC			140	370							3200											
Dieldrin											25000	18000	890		890	280					0.0021	
Endosulfan I																						
Endosulfan II																					0.093	0.079
Endosulfan sulfate							41															
Endrin			2																			
gamma-BHC (Lindane)																						

TABLE 5-10
COMPARISON OF LONG-TERM MONITORING MAXIMUM ANALYTE CONCENTRATIONS WITH RI RESULTS IN SEDIMENT

Analytes	Phase I RI	Phase II RI	1qtr1yr (Nov 1994)		2qtr1yr (Jan 1995)		3qtr1yr (Apr 1995)		4qtr1yr (Jul 1995)		1qtr2yr (Oct 95)		2qtr2yr (Mar 96)		3qtr2yr (May 96)		4qtr2yr (Aug 96)		1Evnt3Yr (Jul 97)		2Evnt3Yr (Jan 97)	
			0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in
gamma-Chlordane												38								0.02	0.023	
Heptachlor			180	820	1200	1400		110	52000	49	7000	4600	600	390	310	190						
Heptachlor epoxide						210															0.0028	
Methoxychlor			19																			
Toxaphene																						
Volatile Organics (mg/kg)																						
1,1,1,2-Tetrachloroethane			2.6																			
1,1,1-Trichloroethane												29			2.6							
1,1,2,2-Tetrachloroethane																			0.0027			
1,1,2-Trichloroethane																					0.0016	
1,1-Dichloroethane												2.5			1.7							
1,1-Dichloroethene																						
1,2,3-Trichloropropane			1.7																			
1,2-Dichloroethane							2.1	6.8														
1,2-Dichloropropane																						
2-Butanone (MEK)			6.9	12	21	26	2900	51	80	15	62	99	25	7.9	250	19	56	71	0.047	0.037	0.048	0.018
2-Chlorethyl vinyl ether																						
2-Hexanone					14																	
4-Methyl-2-pentanone (MIBK)					5																	
Acetone	1700	51	100	62	100	130	950	240	490	82	120	54	200	70	740	62	190	79	0.026	0.19	0.23	0.097
Acrolein										10									0.0015			
Acrylonitrile			4.5																		0.021	
Benzene		1		2.2		1.5	1.7	5.6														
Bromodichloromethane																						
Bromoform																						
Bromomethane																						
Carbon disulfide	36	2	11	15	5.6	2.9	1.5	11	8.7	9.6	4.1	7.6	4.4		3.2	2.7	5.6	6.4	0.0057	0.0087	0.0092	
Carbon tetrachloride												3.6										
Chlorobenzene	78000	10	41	940	310	3900	18000	64	120	64	180	3.9	240	2500	95	25000	3	13	0.14	0.91	2.1	18
Chloroethane	86																					
Chloroform	9200	2				2.5											3.4		0.025			
Chloromethane			1.8			3.3																
cis-1,3-Dichloropropene																						
Dibromochloromethane																						
Dibromomethane																						
Dichlorodifluoromethane																						
Ethanol																						
Ethyl methacrylate															18	420		1.3	0.0081	0.053		
Ethylbenzene	4		3.3	2.3				2.5														
Iodomethane																						
Methylene chloride	140000	51	24	14	5.4	390	600	15	7.1	7.2	5	6.8	21	4.3	25	24	8.2	3.2	0.005	0.017	0.021	0.0055
Styrene																			0.5	0.33		
Tetrachloroethene	83000	11	7.9	16	5.5		17	5.8	3.6		89	87	11	7.3	2.1	12		33				
Toluene	980	6	12	3.6		2.9	2.1	150	3	2.7	15	8.5	63	150	760	3.1	15	1.4	0.034	0.021		0.013
trans-1,2-Dichloroethene							1.5															
trans-1,3-Dichloropropene																						
trans-1,4-Dichloro-2-butene																					0.0019	
Trichlorethene	4100		16	77	4.1	1.7	1.9	1.9			13	16	3.8	2.4		3.7						
Trichlorofluoromethane																						
Vinyl acetate	.9																		0.0028	0.0013		
Vinyl chloride						15																

TABLE 5-10
COMPARISON OF LONG-TERM MONITORING MAXIMUM ANALYTE CONCENTRATIONS WITH RI RESULTS IN SEDIMENT

Analytes	Phase I RI	Phase II RI	1qtr1yr (Nov 1994)		2qtr1yr (Jan 1995)		3qtr1yr (Apr 1995)		4qtr1yr (Jul 1995)		1qtr2yr (Oct 95)		2qtr2yr (Mar 96)		3qtr2yr (May 96)		4qtr2yr (Aug 96)		1Evnt3Yr (Jul 97)		2Evnt3Yr (Jan 97)	
			0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in
Xylenes (total)	1000	6		3.4	2.3			1.7			2.2	2.4	2.6			770				0.0061		0.0031
Semivolatile Organics (mg/kg)																						
1,2,4,5-Tetrachloro-benzene																						
1,2,4-Trichlorobenzene																						
1,2-Dichlorobenzene	3100		340	200	250	570	850	2200	310		44		3000		140	51						
1,3-Dichlorobenzene	280							100							1600	670	3600			1.2	0.22	0.13
1,4-Dichlorobenzene	4400		60			210		280		46			2400		150	1800	520					0.38
1-Chloronaphthalene			250	5200	610	2400		3500	1300	960	390	420	1500	2600	250	4100	1200		0.051		0.13	1.1
1-Naphthylamine															260	470	350		0.046	0.23	0.16	0.06
2,3,4,6-Tetrachlorophenol																						
2,4,5-Trichlorophenol																						
2,4,6-Trichlorophenol																						
2,4-Dichlorophenol	160																					
2,4-Dimethylphenol			84		50					350					180						0.064	
2,4-Dinitrophenol																						
2,4-Dinitrotoluene																						
2,6-Dichlorophenol																						
2,6-Dinitrotoluene																						
2-Chloronaphthalene	1600			700		210		350	1400	1000	310	600		310		2100	280		0.22	0.053	0.5	0.29
2-Chlorophenol																						
2-Methylnaphthalene	1900		110	150		100	410	1000	1200	100	460		4000		460	10000	610		0.28	0.41	0.47	4.5
2-Methylphenol	68																					
2-Naphthylamine																						
2-Nitrophenol																						
2-Picoline																						
3,3'-Dichlorobenzidine	1700																					
3-Methylcholanthrene																						
3-Nitroaniline													1300			1000					0.25	
3/4-Methylphenol			88			58	140		160	220			440	60								
4,6-Dinitro-2-methylphenol											17000											
4-Aminobiphenyl																						
4-Bromophenyl phenyl ether																						
4-Chloro-3-methylphenol																						
4-Chloroaniline																						
4-Chlorophenyl phenyl ether																						
4-Nitroaniline																						
4-Nitrophenol																						
7,12-Dimethylbenz(a)-anthracene																	230	570				
a,a-Dimethylphenethyl-amine																						
Acenaphthene	1100		410	3100	260	490	1600	1800	8000	510	4200	2000	17000	500	1900	15000	3100	710	2	0.86	2.2	0.28
Acenaphthylene									44								360				0.043	
Acetophenone																					0.11	
Aniline																						
Anthracene	1500		830	4800	620	1400	5800	4400	26000	840	11000	11000	36000	2400	3600	29000	5000	2600	3.2	1.9	4.4	0.44
Azobenzene																						
Benzidine				160			430				350						290					
Benzo(a)anthracene	4800		2900	15000	2100	3000	11000	13000	39000	3200	26000	21000	59000	6200	11000	46000	16000	6300	9.9	4.7	7.1	1.7
Benzo(a)pyrene	4400		2600	14000	2200	3100	9800	11000	26000	3200	26000	19000	45000	4700	10000	35000	14000	6200	11	5	9.3	1.9
Benzo(b)fluoranthene	9200		6100	28000	4000	6000	19000	20000	9800	6600	49000	33000	83000	8300	20000	43000	27000	9300	13	5.9	11	2.3
Benzo(g,h,i)perylene	4100		1800	1200	1300	1700	7600	6800	17000	1900	20000	11000	19000	2000	5400	16000	10000	3600	5.3	2.1	4.3	0.96
Benzo(k)fluoranthene	5300		2400	670	2800	110	15000	81	39000	2600	210	2100		250	410	23000	7400	320	8.6	5.5	12	2

TABLE 5-10
COMPARISON OF LONG-TERM MONITORING MAXIMUM ANALYTE CONCENTRATIONS WITH RI RESULTS IN SEDIMENT

Analytes	Phase I RI	Phase II RI	1qtr1yr (Nov 1994)		2qtr1yr (Jan 1995)		3qtr1yr (Apr 1995)		4qtr1yr (Jul 1995)		1qtr2yr (Oct 95)		2qtr2yr (Mar 96)		3qtr2yr (May 96)		4qtr2yr (Aug 96)		1Evnt3Yr (Jul 97)		2Evnt3Yr (Jan 97)	
			0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in	0-6 in	6-12 in
Benzoic acid			170				70						56	69	50							
Benzyl alcohol													79								0.28	
bis(2-Chloroethoxy)methane																						
bis(2-Chloroethyl)ether																						
bis(2-Chloroisopropyl)ether																						
bis(2-Ethylhexyl)phthalate	46000		7000	7800	8000	11000	7800	23000			7800	5500	11000	24000	6500	22000	4500	8900	7.5	19	13	14
Butyl benzyl phthalate	720		6000				4900		560		230						71		0.47		0.51	
Chrysene	7100		5200	19000	2600	3300	15000	15000	35000	5000	33000	21000	57000	5900	12000	42000	18000	7200	12	6.3	12	2.3
Di-n-butyl phthalate	2200		150	150	130	150				4600	59				54		510		0.2		0.068	0.05
Di-n-octyl phthalate	540		410	400		520	180	11000	700		500	56	1400	8900		210	84	630	0.66	0.5		
Dibenz(a,h,)anthracene	110		750	420	150		1600	1300			1300	2100	6000	570	1100	4100	770	840	1.9	0.9	1.5	0.36
Dibenz(a,j)acridine									1400	89									0.33			
Dibenzofuran	480		250	1500	160	340	1000	1000	5500	310	2500	1600	11000	360	1200	8000	1600		1.2	0.79	1.5	0.18
Diethyl phthalate											120					160						
Dimethyl phthalate					57				660	530	300		86	280								
Diphenylamine																						
Ethyl methanesulfonate																						
Fluoranthene	11000		6400	3800	6300	8100	25000	23000	53000	8000	100000	85000	120000	14000	35000	120000	30000	14000	32	18	24	6.5
Fluorene	880		410	2600	300	560	2400	2200	12000	530	5900	3600	23000	820	1700	16000	2700	620	2.2	1.2	2.5	0.28
Hexachlorobenzene																						
Hexachlorobutadiene																						
Hexachlorocyclopentadiene																						
Hexachloroethane																						
Indeno(1,2,3-cd)pyrene	3800		1700	4600	1100	1600	6100	5600	19000	1700	14000	8200	20000	1900	4700	15000	8900	3400	4.7	2.2	4.5	1
Isophorone							98			57												0.47
Methyl methanesulfonate																						
N-Nitroso-di-n-butylamine																						
N-Nitroso-di-n-propylamine																						
N-Nitrosodiphenylamine						150	50								47							
N-Nitrosopiperidine																						
Naphthalene	690		1000	860	1100	3700	980	1600	5900	800	2500	1100	15000	690	2200	4100	2700	520	1.4	1.7	2.1	4
Nitrobenzene																						
p-Dimethylaminoazobenzene																						
Pentachlorobenzene																						
Pentachloronitrobenzene																						
Pentachlorophenol					55																	
Phenacetin																	490					
Phenanthrene	6700		3800	3700	3300	6200	22000	14000	58000	5200	73000	58000	110000	7100	18000	110000	28000	9100	21	11	16	3.5
Phenol					63																	
Pronamide																						
Pyrene	10000		7800	55000	4500	6400	26000	33000	51000	7100	80000	58000	110000	14000	27000	88000	28000	11000	25	11	16	2.9

TABLE 5-11
STATISTICAL EVALUATION OF ANALYTES DETECTED IN SURFACE WATER SAMPLES
THIRD YEAR LONG-TERM MONITORING

Analyte	Frequency of Detection	Average Result	Maximum Result	Minimum Result
Dissolved Metals - Methods 6010/6020 (mg/kg)				
Aluminum	15/29	0.04	0.15	0.0031
Antimony	12/29	0.0003	0.00051	0.00017
Barium	29/29	0.39	0.59	0.000084
Cadmium	26/29	0.0006	0.0026	0.000054
Calcium	28/29	50.87	71.5	16.7
Chromium	29/29	0.01	0.021	0.0011
Cobalt	25/29	0.0002	0.0014	0.000072
Copper	28/29	0.03	0.22	0.0013
Iron	11/29	0.04	0.1	0.021
Lead	22/29	0.0006	0.0018	0.0001
Magnesium	28/29	23.61	35.3	1.1
Manganese	28/29	0.02	0.12	0.00047
Molybdenum	28/29	0.0027	0.019	0.00019
Nickel	28/29	0.01	0.038	0.00016
Potassium	27/29	2.06	10.7	1.2
Selenium	14/29	0.0015	0.0024	0.00011
Silver	3/29	0.0001	0.000088	0.000035
Sodium	28/29	18.55	32.6	4.1
Thallium	2/29	0.00005	0.000054	0.000044
Vanadium	29/29	0.01	0.02	0.00029
Zinc	28/29	0.02	0.04	0.0036
PCBs and Pesticides - Method 8080 (ug/kg)				
Aroclor 1254	1/29	0.58	0.58	0.58
Semivolatile Organics - Method 8270 (mg/kg)				
bis(2-Ethylhexyl)phthalate	12/29	0.0162	0.14	0.0016
Total Metals - Methods 6010/6020/7060/7470 (mg/kg)				
Aluminum	22/29	0.10	0.73	0.0057
Antimony	12/29	0.0002	0.00055	0.00004
Arsenic	8/29	0.0027	0.0038	0.0022
Barium	29/29	0.40	0.62	0.00017
Cadmium	25/29	0.0013	0.016	0.000073
Calcium	29/29	47.34	72.4	0.25
Chromium	29/29	0.01	0.045	0.0004
Cobalt	29/29	0.0004	0.0018	0.000026
Copper	28/29	0.05	0.51	0.0013
Iron	25/29	0.26	1.9	0.024
Hexavalent Chromium	1/29	0.01	0.01	0.01
Lead	25/29	0.0018	0.015	0.00017
Magnesium	28/29	22.81	36.1	1.2
Manganese	29/29	0.03	0.24	0.00016
Molybdenum	27/29	0.0029	0.02	0.00034
Nickel	29/29	0.01	0.052	0.00026

TABLE 5-11
STATISTICAL EVALUATION OF ANALYTES DETECTED IN SURFACE WATER SAMPLES
THIRD YEAR LONG-TERM MONITORING

Analyte	Frequency of Detection	Average Result	Maximum Result	Minimum Result
Potassium	28/29	2.04	10.1	1.4
Selenium	18/29	0.0015	0.0042	0.00043
Silver	3/29	0.0003	0.00062	0.00013
Sodium	28/29	17.45	29.8	4
Vanadium	28/29	0.01	0.018	0.0008
Zinc	28/29	0.02	0.075	0.0034
Volatile Organics - Method 8260 (mg/kg)				
2-Butanone (MEK)	8/29	0.0025	0.0062	0.0014
Acetone	25/29	0.0050	0.012	0.003
Acrolein	2/29	0.0022	0.0025	0.0019
Acrylonitrile	2/29	0.00245	0.0027	0.0022
Bromoform	1/29	0.0016	0.0016	0.0016
Bromomethane	3/29	0.0043	0.0072	0.0015
Chloromethane	3/29	0.0023	0.0036	0.0011
Dibromochloromethane	1/29	0.0018	0.0018	0.0018
Ethanol	1/29	0.041	0.041	0.041
Iodomethane	2/29	0.0015	0.0018	0.0012
Methylene chloride	9/29	0.0026	0.0059	0.001
Styrene	1/29	0.0034	0.0034	0.0034
Wet Chemistry - Methods 130.2/160.1/160.2/300.0/310.1/410.4/415.1 (mg/kg)				
Alkalinity, Bicarb. as CaCO3 at pH 4.5	24/29	179.33	241	41.9
Alkalinity, Bicarb. as CaCO3 at pH 4.5	4/29	221.25	244	165
Alkalinity, Carb. as CaCO3 at pH 8.3	6/29	7.68	25.7	0.75
Alkalinity, Total as CaCO3 at pH 4.5	24/29	181.58	267	41.9
Alkalinity, Total as CaCO3 at pH 4.5	4/29	221.25	244	165
Chemical Oxygen Demand (Regular)	13/29	15.15	26.8	7.3
Chloride	28/29	10.26	16.8	4
Hardness as CaCO3	28/29	208.81	312	54.7
Sulfate	28/29	49.26	232	2.1
Total Dissolved Solids	28/29	288.75	507	90
Total Organic Carbon	28/29	3.63	10.5	0.36
Total Suspended Solids	11/29	20.85	136	1.6

TABLE 5-12
MAXIMUM DETECTED CONCENTRATIONS AND ASSOCIATE SAMPLE LOCATIONS FOR ANALYTES DETECTED IN SURFACE WATER SAMPLES THIRD YEAR LONG-TERM MONITORING

Analyte	Result	Client Description	Footnotes	Detection Limit
Dissolved Metals - Methods 6010/6020 (mg/kg)				
Aluminum	0.15	SC-QE10-SW-901		0.015
Antimony	0.00051	SC-QW03-SW-901	J	0.003
Barium	0.59	SC-QE08-SW-1001		0.001
Cadmium	0.0026	SC-QE07-SW-901		0.0003
Calcium	71.5	SC-QE08-SW-1001		0.2
Chromium	0.021	SC-QE08-SW-1001		0.001
Cobalt	0.0014	SC-QW03-SW-901		0.0005
Copper	0.22	SC-QE02-SW-1001		0.001
Iron	0.1	SC-QW03-SW-901		0.1
Lead	0.0018	SC-QE10-SW-901		0.001
Magnesium	35.3	SC-QE08-SW-1001		0.2
Manganese	0.12	SC-QW07-SW-1001		0.001
Molybdenum	0.019	SC-QW03-SW-901		0.001
Nickel	0.038	SC-QW03-SW-901		0.0002
Potassium	10.7	SC-QW07-SW-1001		5
Selenium	0.0024	SC-QW07-SW-1001	J	0.005
Silver	0.000088	SC-QE11-SW-1001	J	0.001
Sodium	32.6	SC-QW05-SW-1001		5
Thallium	0.000054	SC-QE03-SW-901	J	0.0001
Vanadium	0.02	SC-QE08-SW-1001		0.005
Vanadium	0.02	SC-QE09-SW-1001		0.005
Vanadium	0.02	SC-QW05-SW-1001		0.005
Zinc	0.04	SC-QW05-SW-1001		0.01
PCBs and Pesticides - Method 8080 (ug/kg)				
Aroclor 1254	0.58	SC-QE02-SW-901	J	0.98
Semivolatile Organics - Method 8270 (mg/kg)				
bis(2-Ethylhexyl)phthalate	0.14	SC-QE09-SW-1001	B	0.0095
Total Metals - Methods 6010/6020/7060/7470 (mg/kg)				
Aluminum	0.73	SC-QW07-SW-1001		0.05
Antimony	0.00055	SC-QW03-SW-901	J	0.003
Arsenic	0.0038	SC-QW07-SW-1001	J	0.005
Barium	0.62	SC-QE09-SW-1001		0.001
Cadmium	0.016	SC-QE09-SW-1001		0.001
Calcium	72.4	SC-QE02-SW-901		0.2
Chromium	0.045	SC-QE09-SW-1001		0.001
Cobalt	0.0018	SC-QW03-SW-901		0.0005
Copper	0.51	SC-QE02-SW-1001		0.001
Iron	1.9	SC-QW07-SW-1001		0.1
Hexavalent Chromium	0.01	SC-QE03-SW-901		0.01
Lead	0.015	SC-QE09-SW-1001		0.001
Magnesium	36.1	SC-QE02-SW-901		0.2
Manganese	0.24	SC-QW07-SW-1001		0.001
Molybdenum	0.02	SC-QW03-SW-901		0.001
Nickel	0.052	SC-QW03-SW-901		0.0002

TABLE 5-12
MAXIMUM DETECTED CONCENTRATIONS AND ASSOCIATE SAMPLE LOCATIONS FOR ANALYTES DETECTED IN SURFACE WATER SAMPLES THIRD YEAR LONG-TERM MONITORING

Analyte	Result	Client Description	Footnotes	Detection Limit
Potassium	10.1	SC-QW07-SW-1001		5
Selenium	0.0042	SC-QE02-SW-901	J	0.005
Silver	0.00062	SC-QE09-SW-1001	J	0.001
Sodium	29.8	SC-QW05-SW-1001		5
Vanadium	0.018	SC-QE02-SW-901		0.0005
Zinc	0.075	SC-QE02-SW-1001		0.01
Volatile Organics - Method 8260 (mg/kg)				
2-Butanone (MEK)	0.0062	SC-QE07-SW-901	J	0.01
Acetone	0.012	SC-QE02-SW-1001		0.01
Acrolein	0.0025	SC-QE09-SW-901	J	0.1
Acrylonitrile	0.0027	SC-QE09-SW-901	J	0.1
Bromoform	0.0016	SC-QE03-SW-901	J	0.005
Bromomethane	0.0072	SC-QW05-SW-901	J	0.01
Chloromethane	0.0036	SC-QW05-SW-901	J	0.01
Dibromochloromethane	0.0018	SC-QE03-SW-901	J	0.005
Ethanol	0.041	SC-QE02-SW-901	J	0.5
Iodomethane	0.0018	SC-QW05-SW-901	J	0.005
Methylene chloride	0.0059	SC-QE03-SW-901	B	0.005
Styrene	0.0034	SC-QW03-SW-901	J	0.005
Wet Chemistry - Methods 130.2/160.1/160.2/300.0/310.1/410.4/415.1 (mg/kg)				
Alkalinity, Bicarb. as CaCO3 at pH 4.5	244	SC-QE08-SW-1001		5
Alkalinity, Bicarb. as CaCO3 at pH 4.5	244	SC-QE09-SW-1001		5
Alkalinity, Bicarb. as CaCO3 at pH 4.5	241	SC-QW05-SW-1001		5
Alkalinity, Carb. as CaCO3 at pH 8.3	25.7	SC-QW05-SW-1001		5
Alkalinity, Total as CaCO3 at pH 4.5	244	SC-QE08-SW-1001		5
Alkalinity, Total as CaCO3 at pH 4.5	244	SC-QE09-SW-1001		5
Alkalinity, Total as CaCO3 at pH 4.5	267	SC-QW05-SW-1001		5
Chemical Oxygen Demand (Regular)	26.8	SC-QW07-SW-1001		20
Chloride	16.8	SC-QE02-SW-901		0.5
Hardness as CaCO3	312	SC-QE02-SW-901		5
Sulfate	232	SC-QE02-SW-901		2.5
Total Dissolved Solids	507	SC-QE02-SW-901		10
Total Organic Carbon	10.5	SC-QW03-SW-901		1
Total Suspended Solids	136	SC-QE09-SW-1001		2

[1] B=Compound is also detected in blank

J=Result is detected below the reporting limit or is an estimated concentration

TABLE 5-13
COMPARISON OF LONG-TERM MONITORING MAXIMUM ANALYTE CONCENTRATIONS WITH RI RESULTS IN SURFACE WATER

Analytes	Phase I RI	Phase II RI	1Qtr1Yr (Nov 1994)	2Qtr1Yr (Jan 1995)	3Qtr1Yr (Apr 1995)	4Qtr1Yr (Jul 1995)	1Qtr2Yr (Oct 95)	2Qtr2Yr (Mar 96)	3Qtr2Yr (May 96)	4Qtr2Yr (Aug 96)	1Evnt3Yr (Jan 97)	2Evnt3Yr (Jul 97)
Metals (mg/L)												
Aluminum	7.43		4.3	0.55	0.7	0.15	0.053	0.038	0.18	0.21	0.06	0.73
Antimony							0.046	0.00091	0.00037	0.00051	0.00055	
Arsenic	0.0098		0.0026	0.0035	0.0024	0.0031	0.0015	0.0033	0.0033	0.0029	0.0027	0.0038
Barium	1.9		0.61	0.46	0.44	0.68	0.54	0.37	0.49	0.65	0.55	0.62
Beryllium	0.001								0.00068	0.00014		
Boron												
Cadmium	0.0569	0.0094	0.0036	0.0061				0.001	0.0034	0.0053	0.0012	0.016
Calcium	117		92.4	74.4	61.2	99.6	103	67.9	103	91.1	72.4	66.9
Chromium	0.628	0.0369	0.039	0.52	0.031	0.056	0.014	0.0097	0.015	0.02	0.014	0.045
Cobalt	0.324		0.031	0.0068	0.008			0.0012	0.0017	0.00054	0.0018	0.001
Copper	0.985		0.11	0.08	0.098	0.3	0.27	0.049	0.14	0.36	0.083	0.51
Iron	4.55		3.4	1.3	1.4	0.28	0.12	1.5	1.7	1.1	0.44	1.9
Lead	0.325	0.0345	0.0066	0.03	0.0054	0.0048	0.0028	0.0035	0.016	0.0001	0.0016	0.015
Magnesium	40.8		44.3	33.3	29.9	45.7	47.2	32.5	49.8	44.7	36.1	33.3
Manganese	3.06		0.35	0.13	0.44	0.14	0.086	0.12	0.23	0.091	0.067	0.24
Mercury				0.00018								
Molybdenum			0.57	0.42	0.2	0.3	0.5	0.29	0.56	0.013	0.02	0.0026
Nickel	3.56		0.33	0.093	0.033	0.016	0.011	0.032	0.049	0.015	0.052	0.013
Potassium	6.68		5.7	5	4.5	5.7	5.4	9.6	6.2	3.6	2.3	10.1
Selenium	0.0209		0.0036	0.0041	0.0041	0.0024	0.0027	0.0028	0.021	0.0042	0.0042	0.0018
Silver	0.0131										0.00013	0.00062
Sodium	130		203	106	123	111	179	200	114	68	29.3	29.8
Thallium					0.0012							
Tin												
Vanadium	0.067		0.028	0.018	0.017	0.03	0.026	0.019	0.026	0.023	0.018	0.017
Zinc	2.4		0.068	0.044	0.034	0.032	0.055	0.076	0.1	0.026	0.036	0.075
PCB's and Chlorinated Pesticides (ug/L)												
4,4'-DDD												

TABLE 5-13
COMPARISON OF LONG-TERM MONITORING MAXIMUM ANALYTE CONCENTRATIONS WITH RI RESULTS IN SURFACE WATER

Analytes	Phase I RI	Phase II RI	1Qtr1Yr (Nov 1994)	2Qtr1Yr (Jan 1995)	3Qtr1Yr (Apr 1995)	4Qtr1Yr (Jul 1995)	1Qtr2Yr (Oct 95)	2Qtr2Yr (Mar 96)	3Qtr2Yr (May 96)	4Qtr2Yr (Aug 96)	1Evnt3Yr (Jan 97)	2Evnt3Yr (Jul 97)
4,4'-DDE												
4,4'-DDT												
Aldrin								0.075				
alpha-BHC				0.086								
alpha-Chlordane												
Aroclor 1016												
Aroclor 1221												
Aroclor 1232												
Aroclor 1242												
Aroclor 1248												
Aroclor 1254												
Aroclor 1260											0.58	
beta-BHC												
delta-BHC												
Dieldrin												
Endosulfan I												
Endosulfan II												
Endosulfan sulfate												
Endrin												
gamma-BHC (Lindane)												
gamma-Chlordane												
Heptachlor												
Heptachlor epoxide												
Methoxychlor												
Toxaphene												
Volatile Organics (mg/L)												
1,1,1,2-Tetrachloroethane												
1,1,1-Trichloroethane	2	5										
1,1,2,2-Tetrachloroethane												
1,1,2-Trichloroethane		2										

TABLE 5-13
COMPARISON OF LONG-TERM MONITORING MAXIMUM ANALYTE CONCENTRATIONS WITH RI RESULTS IN SURFACE WATER

Analytes	Phase I RI	Phase II RI	1Qtr1Yr (Nov 1994)	2Qtr1Yr (Jan 1995)	3Qtr1Yr (Apr 1995)	4Qtr1Yr (Jul 1995)	1Qtr2Yr (Oct 95)	2Qtr2Yr (Mar 96)	3Qtr2Yr (May 96)	4Qtr2Yr (Aug 96)	1Evnt3Yr (Jan 97)	2Evnt3Yr (Jul 97)
1,1-Dichloroethane												
1,1-Dichloroethene												
1,2,3-Trichloropropane												
1,2-Dichloroethane												
1,2-Dichloropropane												
2-Butanone (MEK)			2.8									
2-Chlorethyl vinyl ether							5.4			2.7	0.0062	
2-Hexanone												
4-Methyl-2-pentanone (MIBK)										5.4		
Acetone	5	60	11	4.6	8.4	12	26	4.4	12	24	0.0072	0.012
Acrolein											0.0025	
Acrylonitrile											0.0027	
Benzene		2										
Bromodichloromethane	6	0.9										
Bromoform	4	15	1.9		2.6	1.8	4.0		1.9	2.6	0.0016	
Bromomethane											0.0072	
Carbon disulfide		1		1				4	2.5			
Carbon tetrachloride												
Chlorobenzene		2		1.8								
Chloroethane												
Chloroform	6	9		1.8					1.0			
Chloromethane											0.0036	
cis-1,3-Dichloropropene												
Dibromochloromethane	5									1.1	0.0018	
Dibromomethane												
Dichlorodifluoromethane							2.4					
Ethanol											0.041	
Ethyl methacrylate												
Ethylbenzene												
Iodomethane											0.0018	
Methylene chloride	14	620	11	150	2.8	5.1	150	2.3	2.3	12	0.0059	0.0014

TABLE 5-13
COMPARISON OF LONG-TERM MONITORING MAXIMUM ANALYTE CONCENTRATIONS WITH RI RESULTS IN SURFACE WATER

Analytes	Phase I RI	Phase II RI	1Qtr1Yr (Nov 1994)	2Qtr1Yr (Jan 1995)	3Qtr1Yr (Apr 1995)	4Qtr1Yr (Jul 1995)	1Qtr2Yr (Oct 95)	2Qtr2Yr (Mar 96)	3Qtr2Yr (May 96)	4Qtr2Yr (Aug 96)	1Evnt3Yr (Jan 97)	2Evnt3Yr (Jul 97)
Styrene												
Tetrachloroethene	3	6	11	7.6	2.1						0.0034	
Toluene	1	5		1.4					1.5			
trans-1,2-Dichloroethene									3.6			
trans-1,3-Dichloropropene												
trans-1,4-Dichloro-2-butene												
Trichlorethene			3.1	14	1.6			9.4	13			
Trichlorofluoromethane												
Vinyl acetate												
Vinyl chloride					1							
Xylenes (total)		2										
Semivolatile Organics (mg/L)												
1,2,4,5-Tetrachloro-benzene												
1,2,4-Trichlorobenzene												
1,2-Dichlorobenzene												
1,3-Dichlorobenzene							1.7			1.0		
1,4-Dichlorobenzene												
1-Chloronaphthalene												
1-Naphthylamine												
2,3,4,6-Tetrachlorophenol												
2,4,5-Trichlorophenol												
2,4,6-Trichlorophenol												
2,4-Dichlorophenol										0.96		
2,4-Dimethylphenol												
2,4-Dinitrophenol												
2,4-Dinitrotoluene												
2,6-Dichlorophenol												
2,6-Dinitrotoluene										2.8		
2-Chloronaphthalene												
2-Chlorophenol										1.4		

TABLE 5-13
COMPARISON OF LONG-TERM MONITORING MAXIMUM ANALYTE CONCENTRATIONS WITH RI RESULTS IN SURFACE WATER

Analytes	Phase I RI	Phase II RI	1Qtr1Yr (Nov 1994)	2Qtr1Yr (Jan 1995)	3Qtr1Yr (Apr 1995)	4Qtr1Yr (Jul 1995)	1Qtr2Yr (Oct 95)	2Qtr2Yr (Mar 96)	3Qtr2Yr (May 96)	4Qtr2Yr (Aug 96)	1Evnt3Yr (Jan 97)	2Evnt3Yr (Jul 97)
2-Methylnaphthalene												
2-Methylphenol												
2-Naphthylamine												
2-Nitrophenol												
2-Picoline												
3,3'-Dichlorobenzidine												
3-Methylcholanthrene												
3-Nitroaniline												
3/4-Methylphenol					1.3	1.7	1.2					
4,6-Dinitro-2-methylphenol												
4-Aminobiphenyl												
4-Bromophenyl phenyl ether												
4-Chloro-3-methylphenol												
4-Chloroaniline												
4-Chlorophenyl phenyl ether												
4-Nitroaniline												
4-Nitrophenol				1.7	2	1.2		1.3				
7,12-Dimethylbenz(a)-anthracene												
a,a-Dimethylphenethyl-amine												
Acenaphthene												
Acenaphthylene												
Acetophenone												
Aniline												
Anthracene								4				
Azobenzene												
Benzidine												
Benzo(a)anthracene								1.2				
Benzo(a)pyrene												
Benzo(b)fluoranthene												
Benzo(g,h,i)perylene	6											
Benzo(k)fluoranthene												

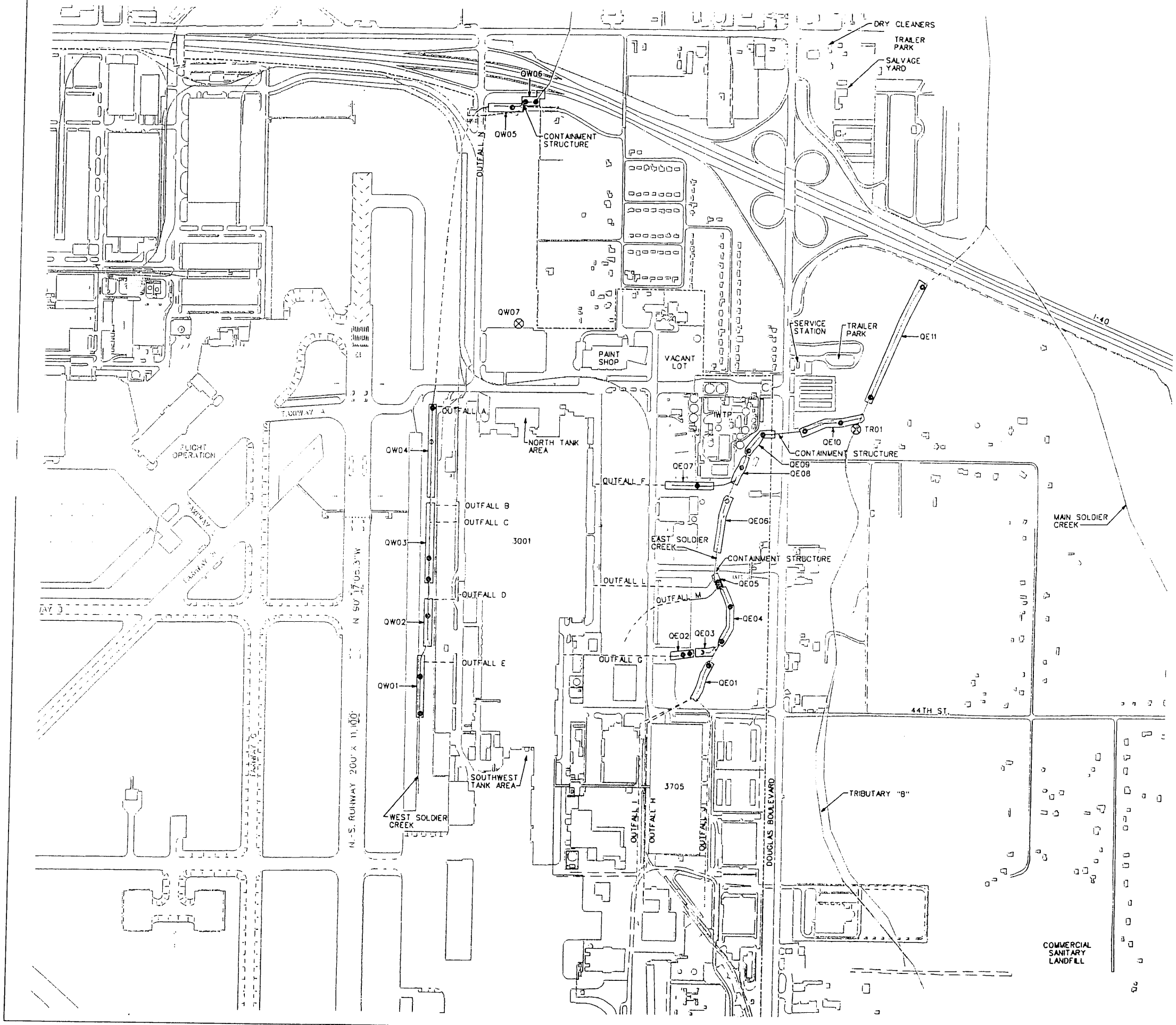
TABLE 5-13
COMPARISON OF LONG-TERM MONITORING MAXIMUM ANALYTE CONCENTRATIONS WITH RI RESULTS IN SURFACE WATER

Analytes	Phase I RI	Phase II RI	1Qtr1Yr (Nov 1994)	2Qtr1Yr (Jan 1995)	3Qtr1Yr (Apr 1995)	4Qtr1Yr (Jul 1995)	1Qtr2Yr (Oct 95)	2Qtr2Yr (Mar 96)	3Qtr2Yr (May 96)	4Qtr2Yr (Aug 96)	1Evnt3Yr (Jan 97)	2Evnt3Yr (Jul 97)
Benzoic acid	0.4				2.9	3.9	1.6	1.2	1.2	1.5		
Benzyl alcohol				1.7	1.2							
bis(2-Chloroethoxy)methane												
bis(2-Chloroethyl)ether												
bis(2-Chloroisopropyl)ether												
bis(2-Ethylhexyl)phthalate			1	3.6						1.3	0.013	0.14
Butyl benzyl phthalate			1				3.2					
Chrysene	5											
Di-n-butyl phthalate										1.4		
Di-n-octyl phthalate												
Dibenz(a,h,)anthracene												
Dibenz(a,j)acridine												
Dibenzofuran										1.1		
Diethyl phthalate						1.2	1.1					
Dimethyl phthalate								1		1.3		
Diphenylamine												
Ethyl methanesulfonate												
Fluoranthene	1			1.5				1.6		1.5		
Fluorene												
Hexachlorobenzene												
Hexachlorobutadiene												
Hexachlorocyclopentadiene												
Hexachloroethane												
Indeno(1,2,3-cd)pyrene												
Isophorone												
Methyl methanesulfonate												
N-Nitroso-di-n-butylamine												
N-Nitroso-di-n-propylamine												
N-Nitrosodiphenylamine												
N-Nitrosopiperidine												
Naphthalene										1.4		

TABLE 5-13
COMPARISON OF LONG-TERM MONITORING MAXIMUM ANALYTE CONCENTRATIONS WITH RI RESULTS IN SURFACE WATER

Analytes	Phase I RI	Phase II RI	1Qtr1Yr (Nov 1994)	2Qtr1Yr (Jan 1995)	3Qtr1Yr (Apr 1995)	4Qtr1Yr (Jul 1995)	1Qtr2Yr (Oct 95)	2Qtr2Yr (Mar 96)	3Qtr2Yr (May 96)	4Qtr2Yr (Aug 96)	1Evnt3Yr (Jan 97)	2Evnt3Yr (Jul 97)
Nitrobenzene												
p-Dimethylaminoazobenzene												
Pentachlorobenzene												
Pentachloronitrobenzene												
Pentachlorophenol												
Phenacetin												
Phenanthrene				1.6								
Phenol				3.5	2.7		2	2		1.4		
Pronamide												
Pyrene	1											

FIGURES



LEGEND:

- SOLDIER CREEK AND TRIBUTARIES
- UNDERGROUND PORTION OF CREEK
- BOUNDARY OF TINKER AIR FORCE BASE
- ⊗ SAMPLING LOCATIONS ON TRIBUTARY B AND QW07
- 1 EVENT 3 YEAR BHRA PAH EXEEDANCE
- 2 EVENT 3 YEAR BHRA PAH EXEEDANCE
- ○ NO EXCEEDANCES

N

800 0 800 1600

SCALE FEET

13 NOV 97 11:43:55
k:\tinker\dgn\soldq-12.dgn

Designed By: D.D.N.	TINKER AIR FORCE BASE		
Drawn By: J.W.B.	OKLAHOMA CITY, OKLAHOMA		
Checked By: D.D.N	TITLE: BHRA PAH EXCEEDANCES FOR 0-6" SEDIMENT SAMPLES		
Submitted By:	PROJECT NUMBER F96526	DATE NOV. 1997	FIG. NO. 5-1

FIGU 2 5-2a

TEMPORAL SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

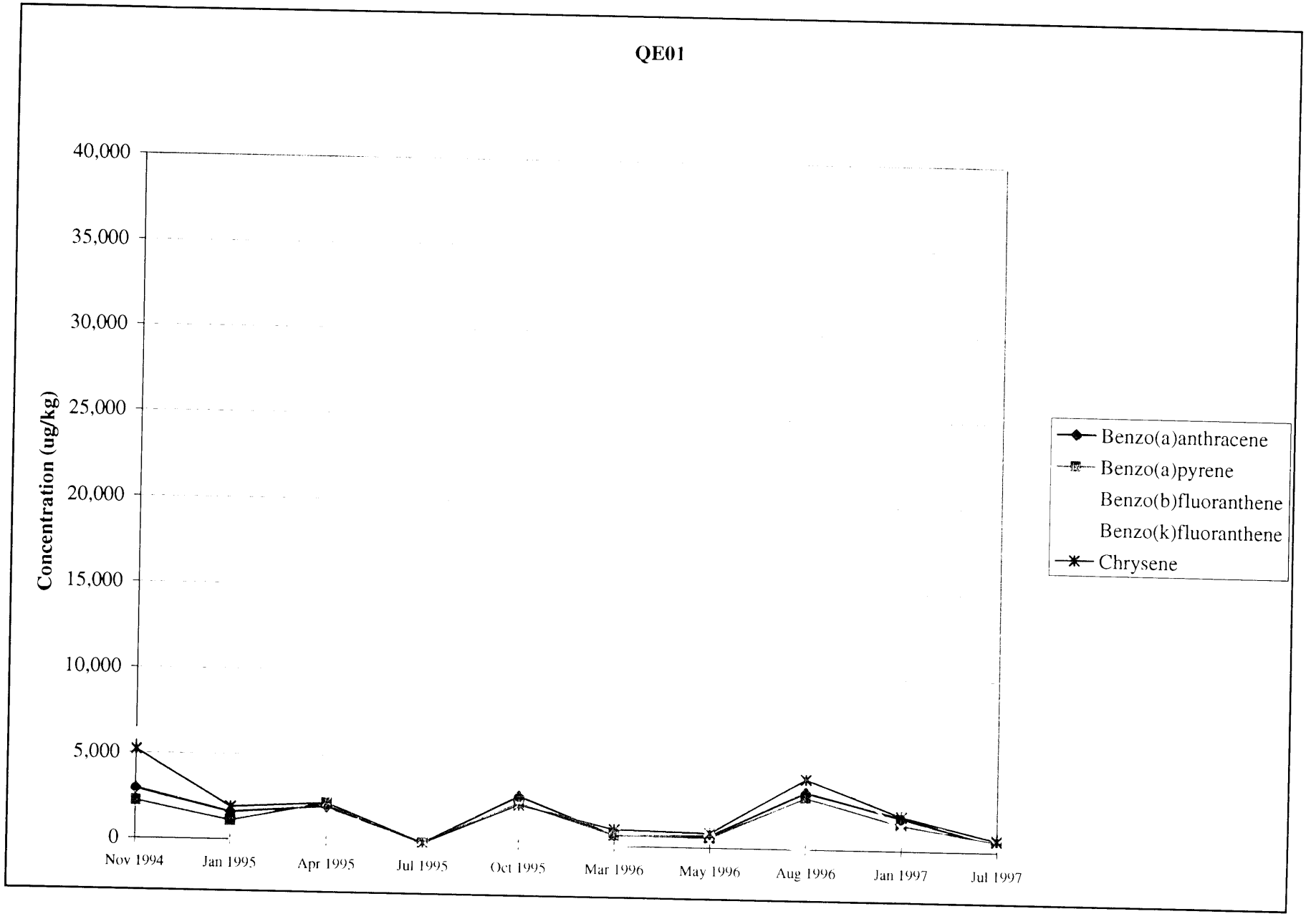


FIGURE 5-2b
TEMPORAL SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

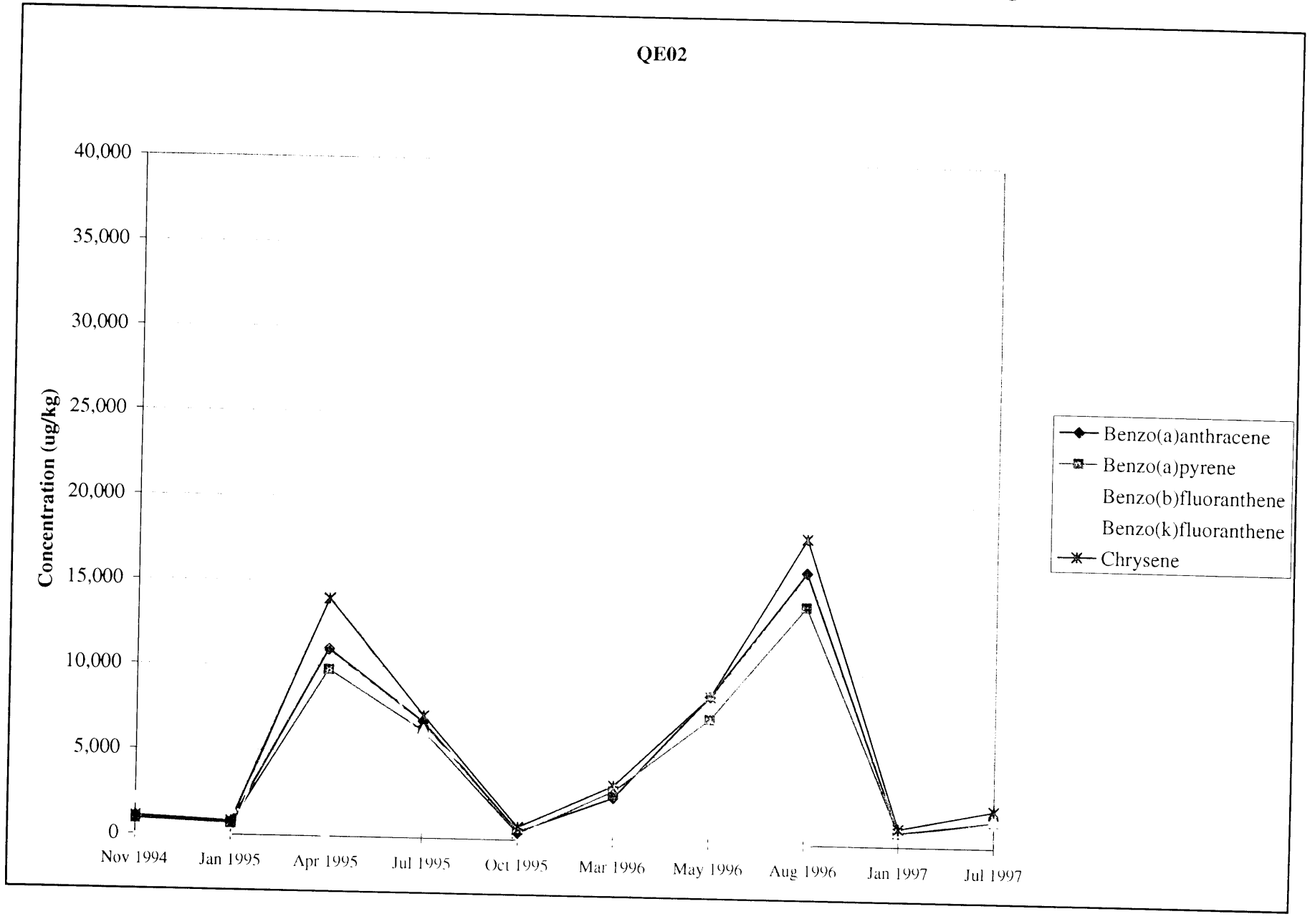
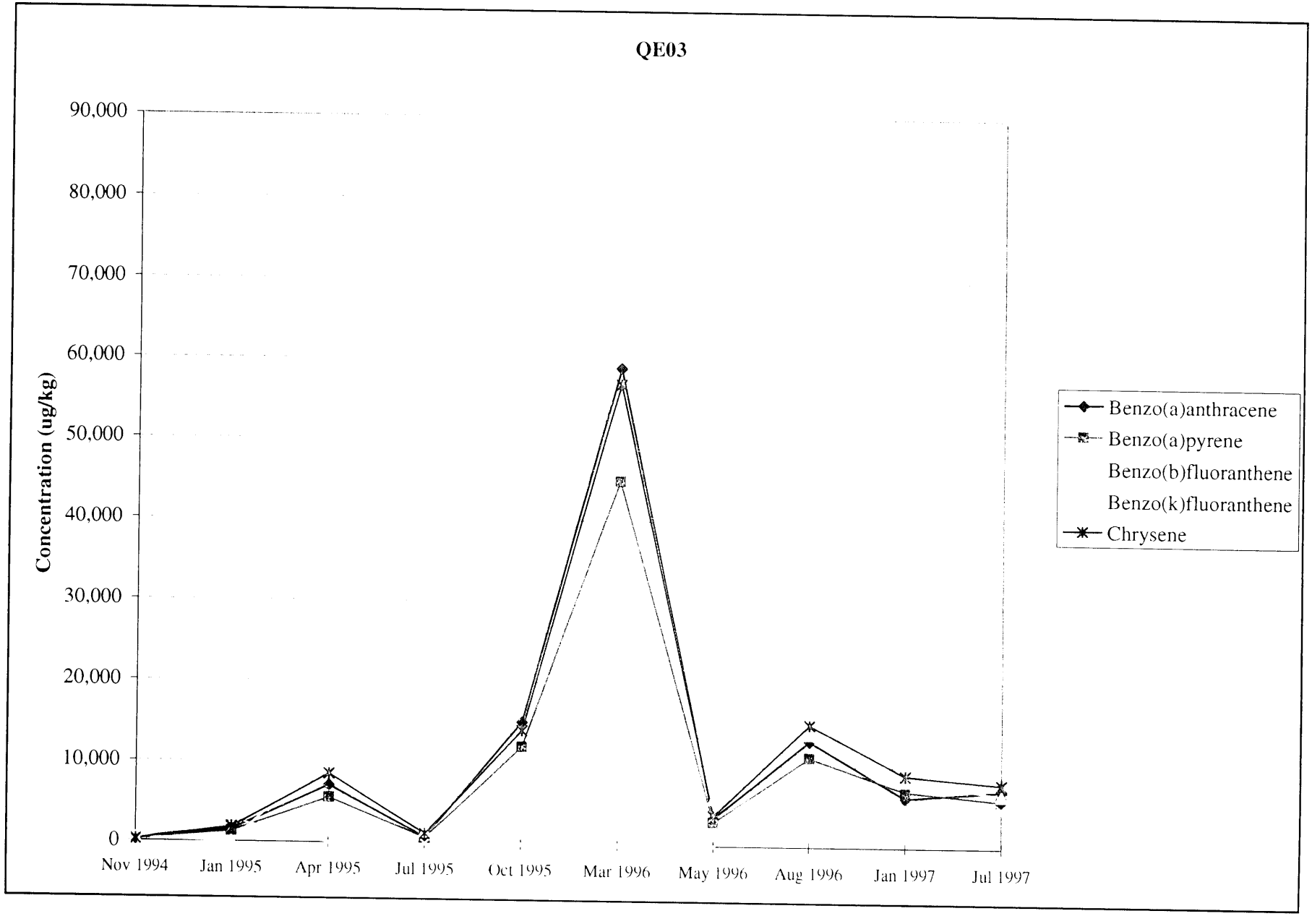


FIGURE 5-2c
TEMPORAL SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)



FIGU_ 5-2d
TEMPORAL SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

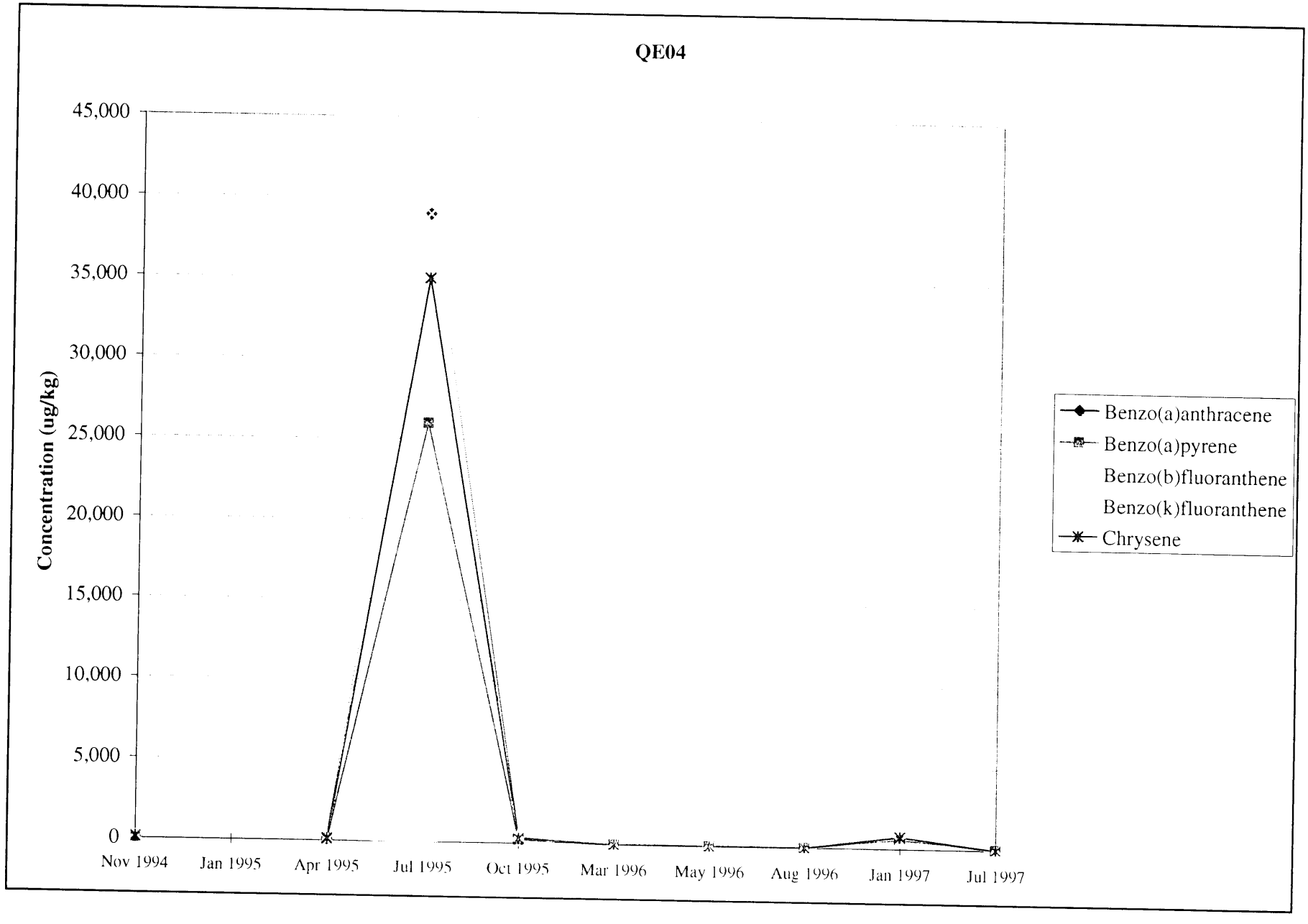


FIGURE 5-2e
TEMPORAL SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

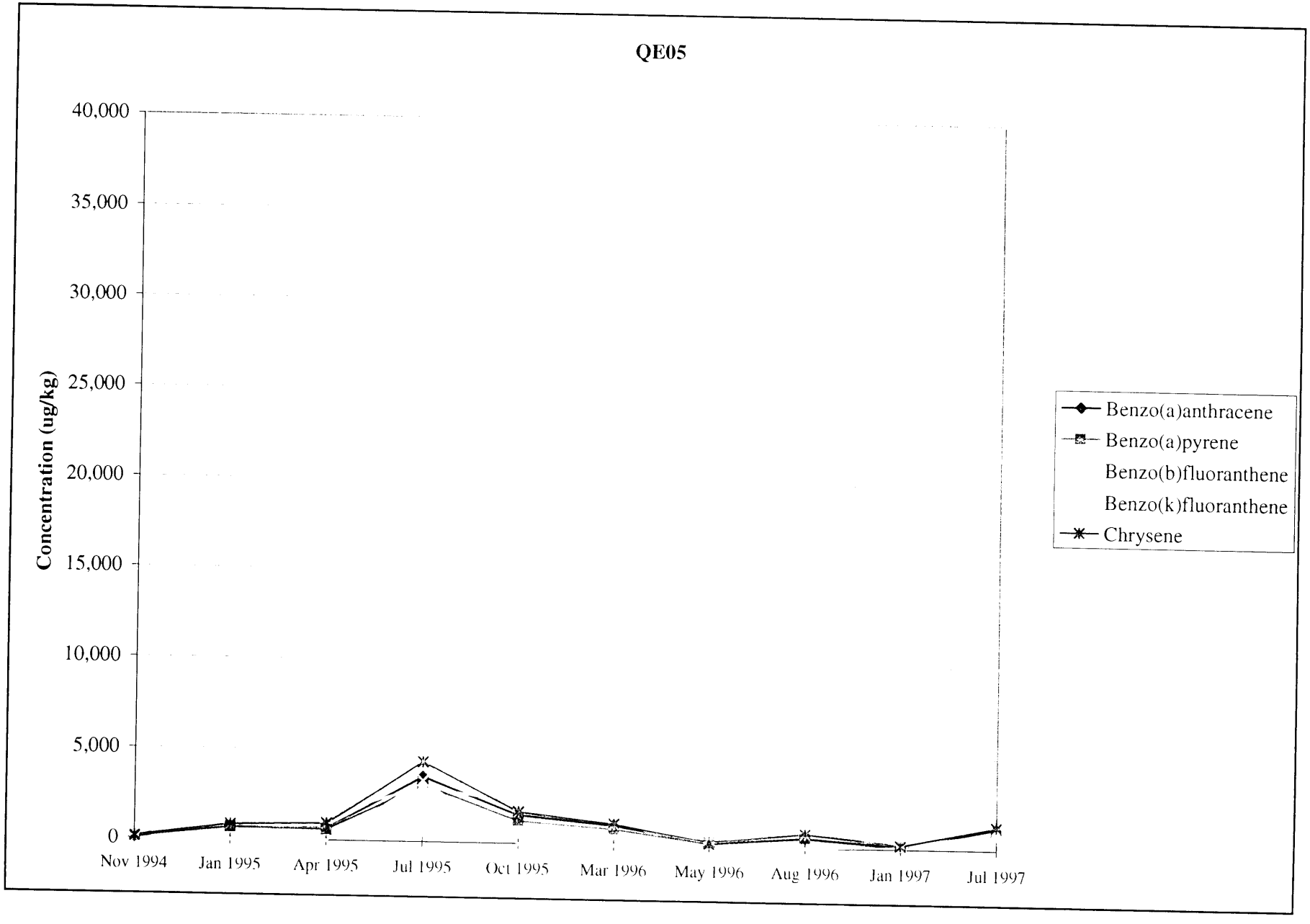


FIG. .E 5-2f

TEMPORAL SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

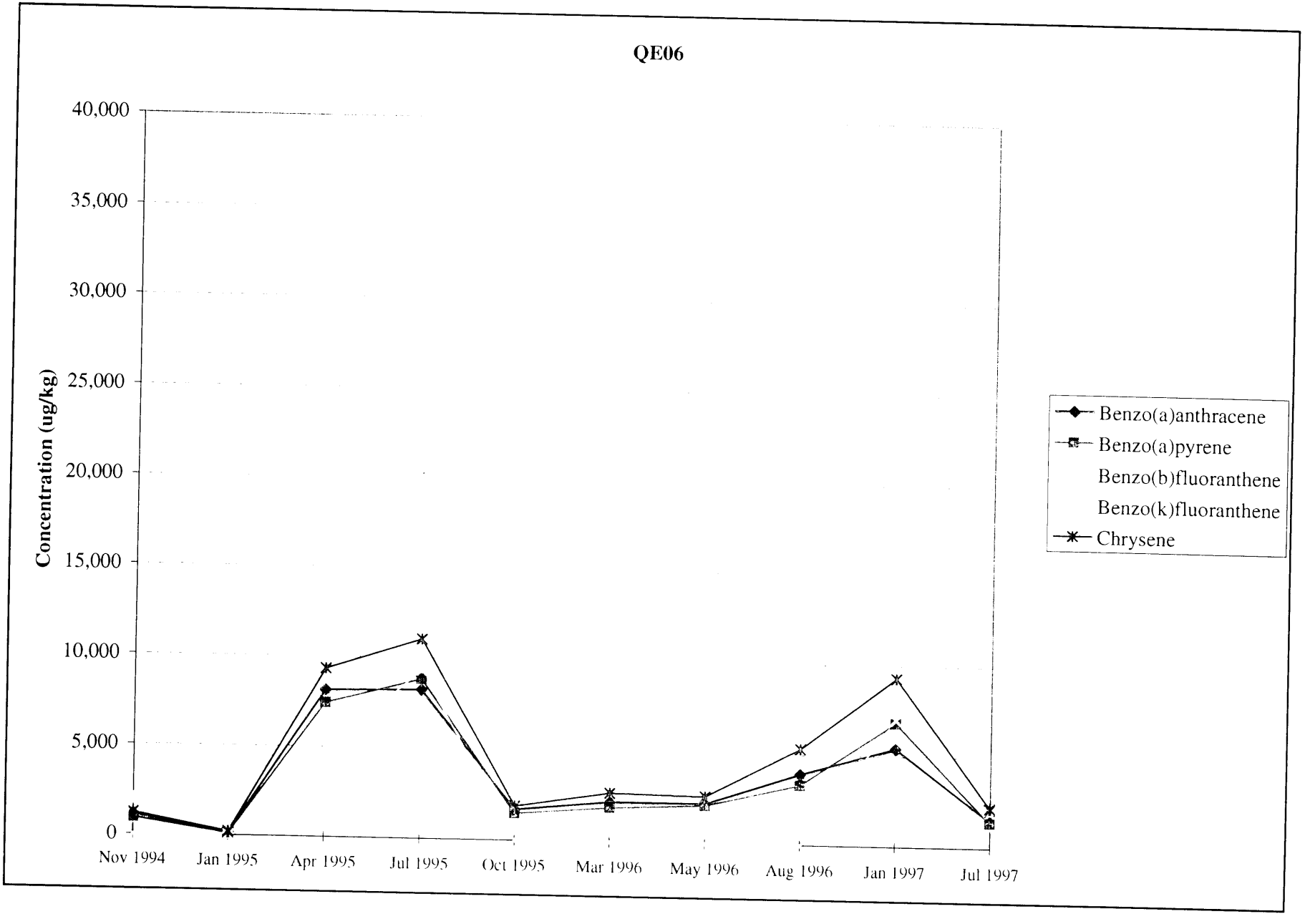


FIGURE 5-2g
TEMPORAL SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

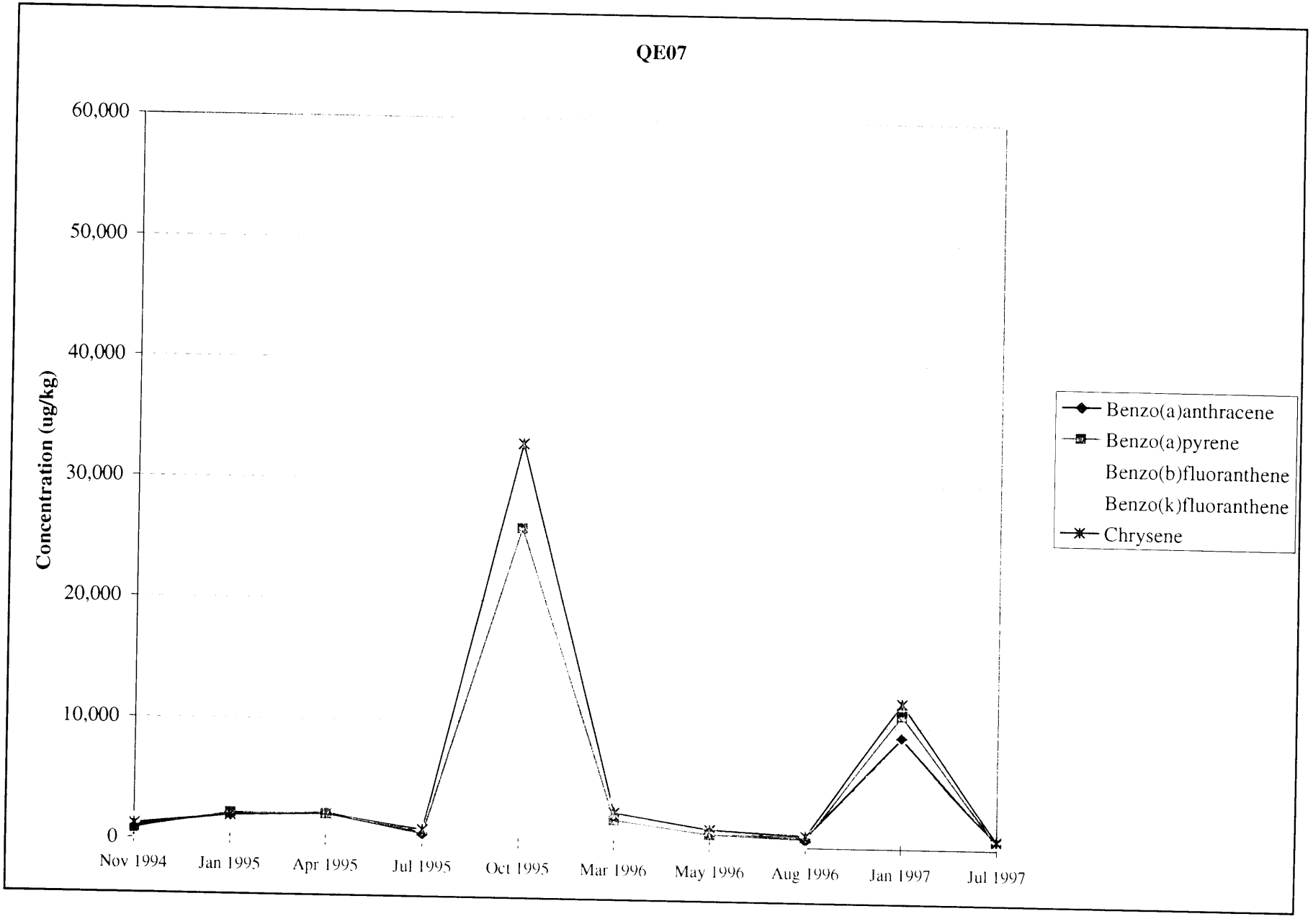


FIGURE 5-2h
TEMPORAL SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

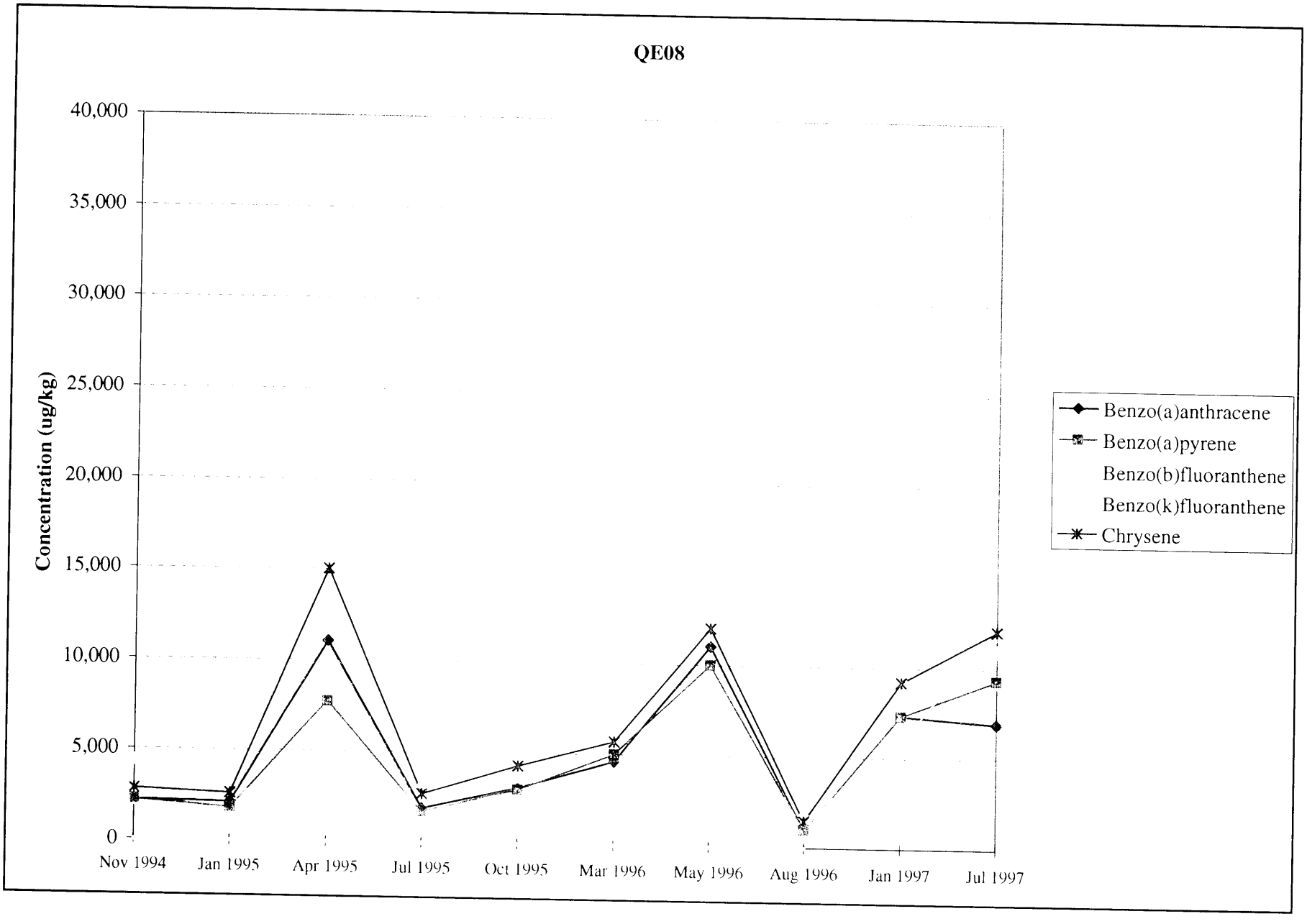


FIGURE 5-2i
TEMPORAL SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

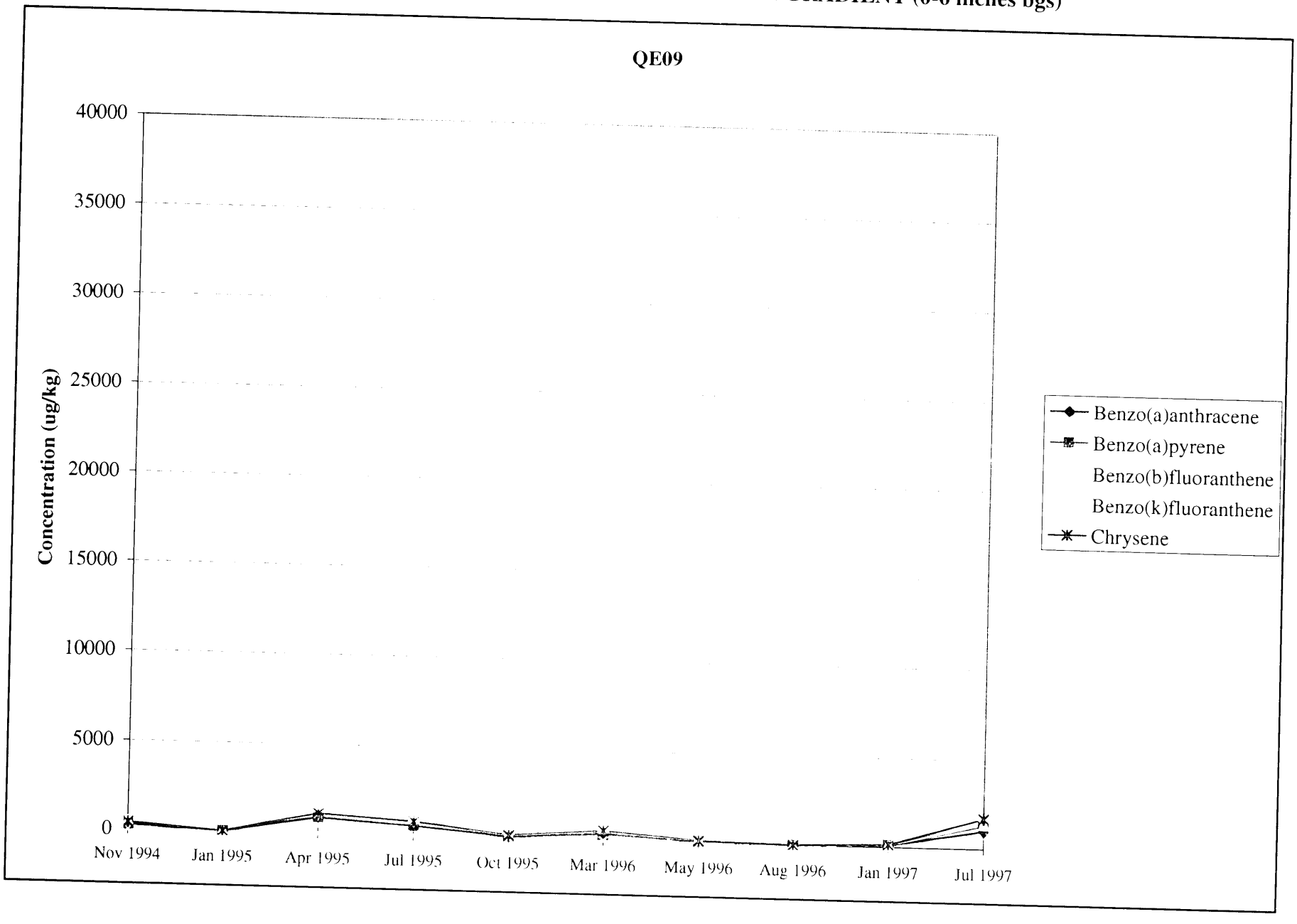


FIGURE 5-2j
TEMPORAL SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

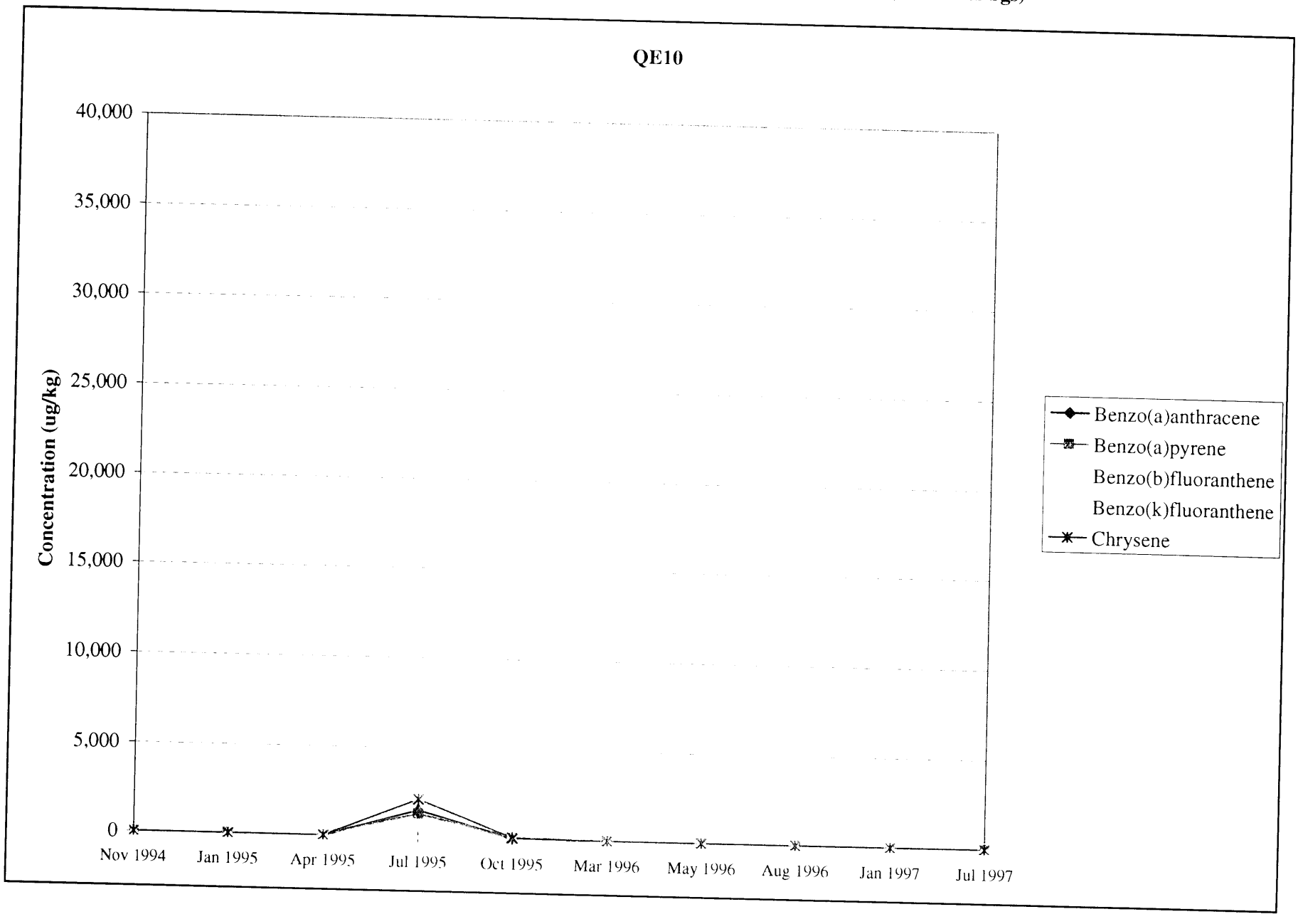


FIGURE 5-2k
TEMPORAL SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

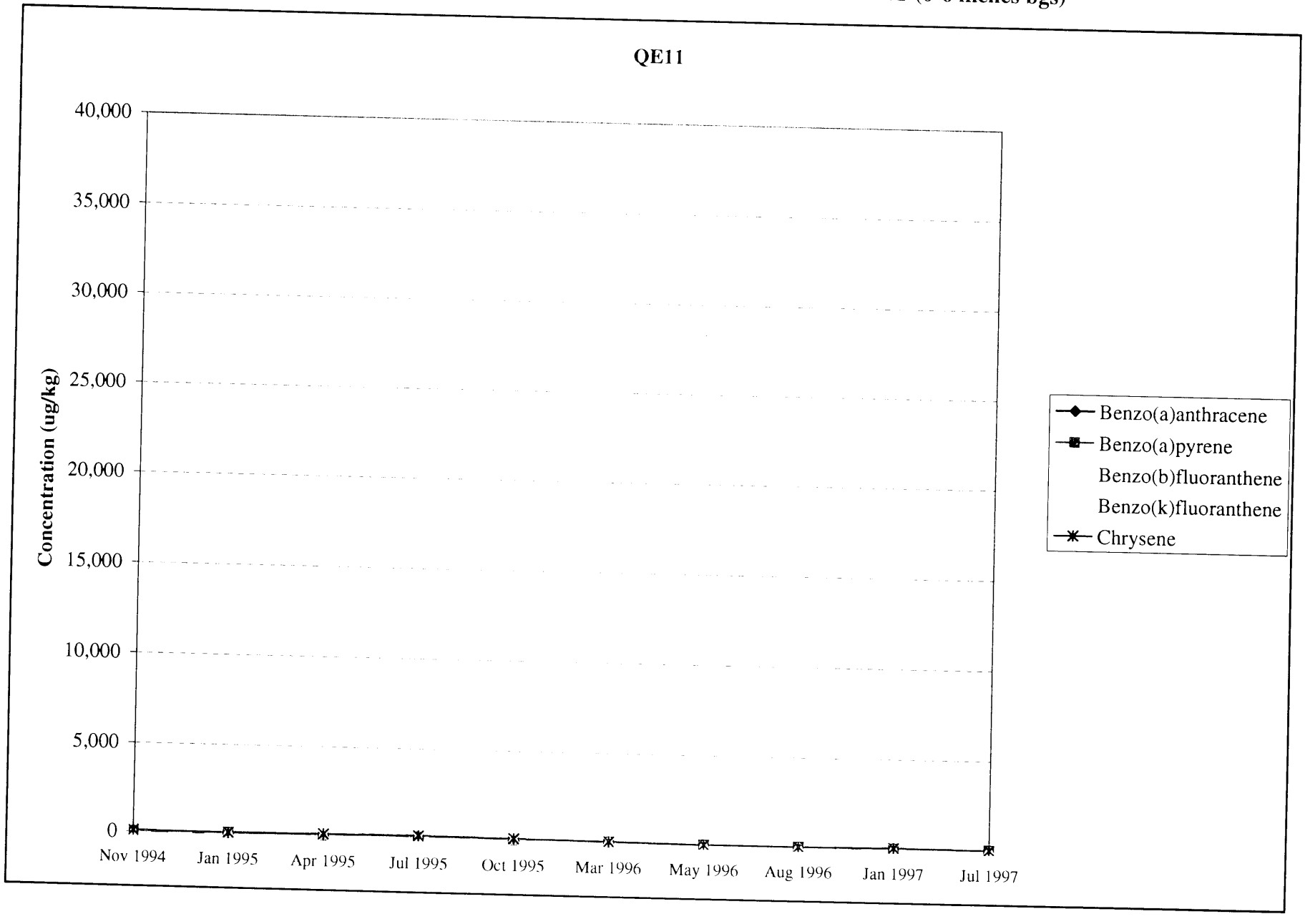


FIGURE 5-21
TEMPORAL SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

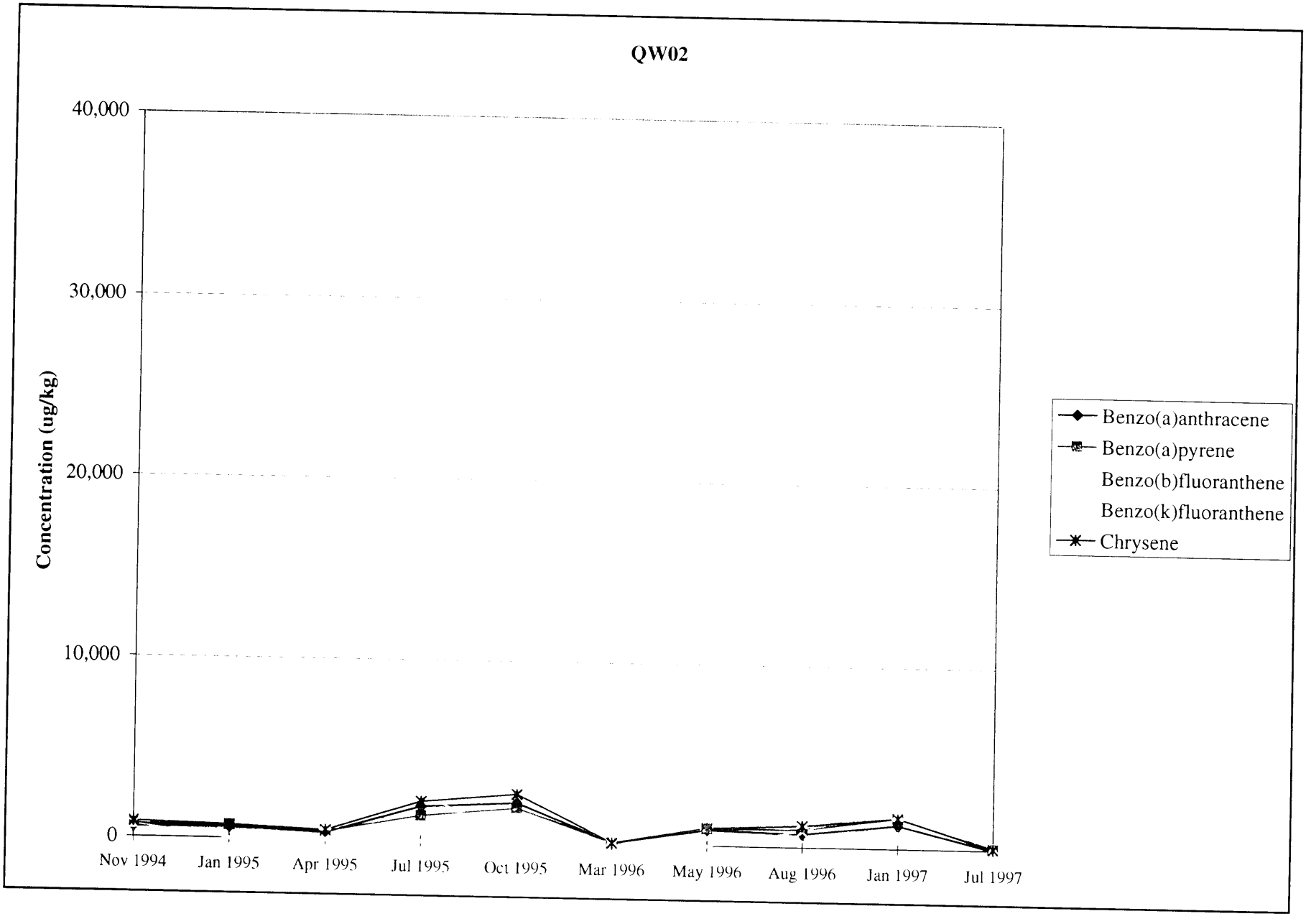


FIGURE 5-2m
TEMPORAL SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

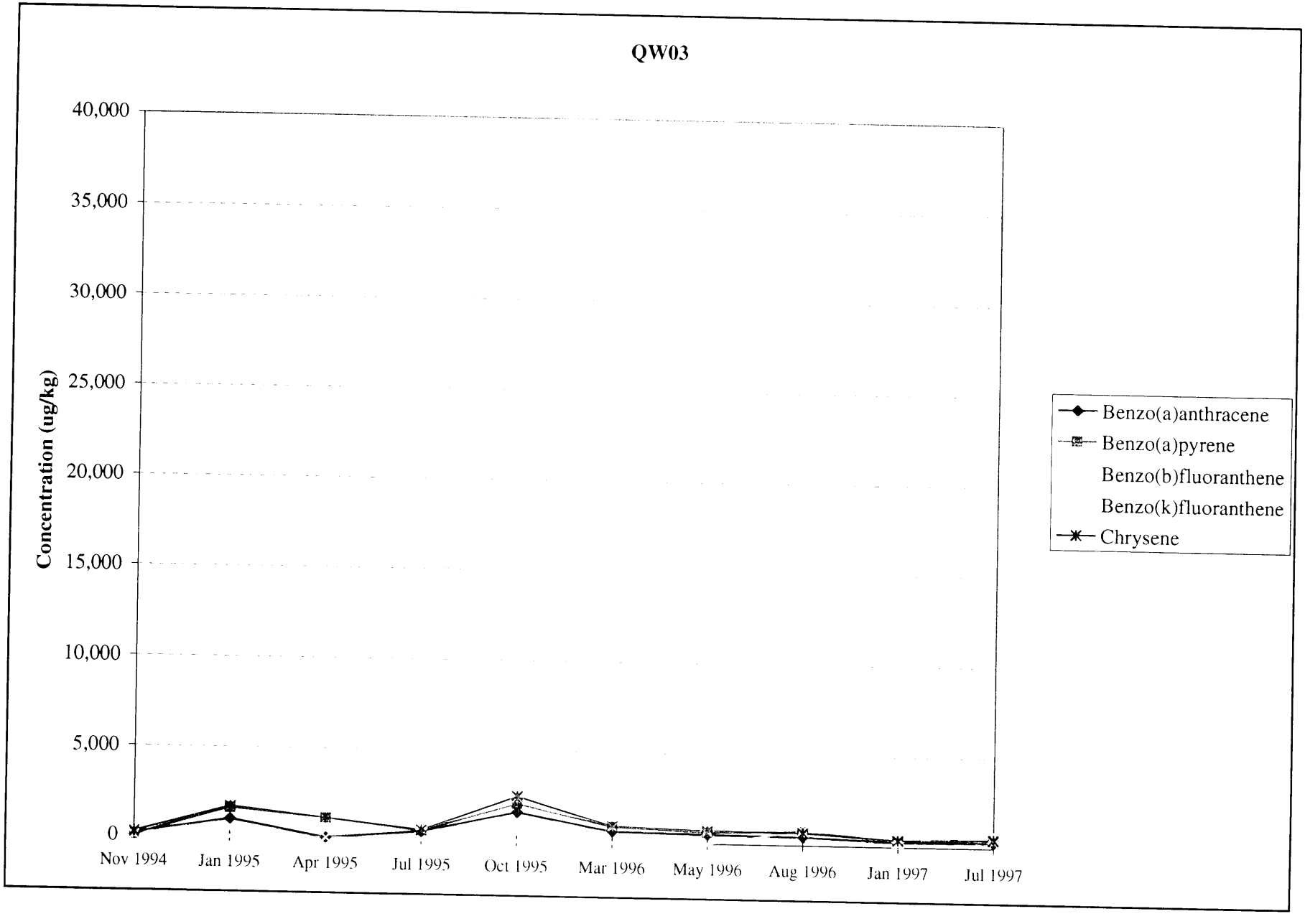


FIGURE 5-2n
TEMPORAL SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

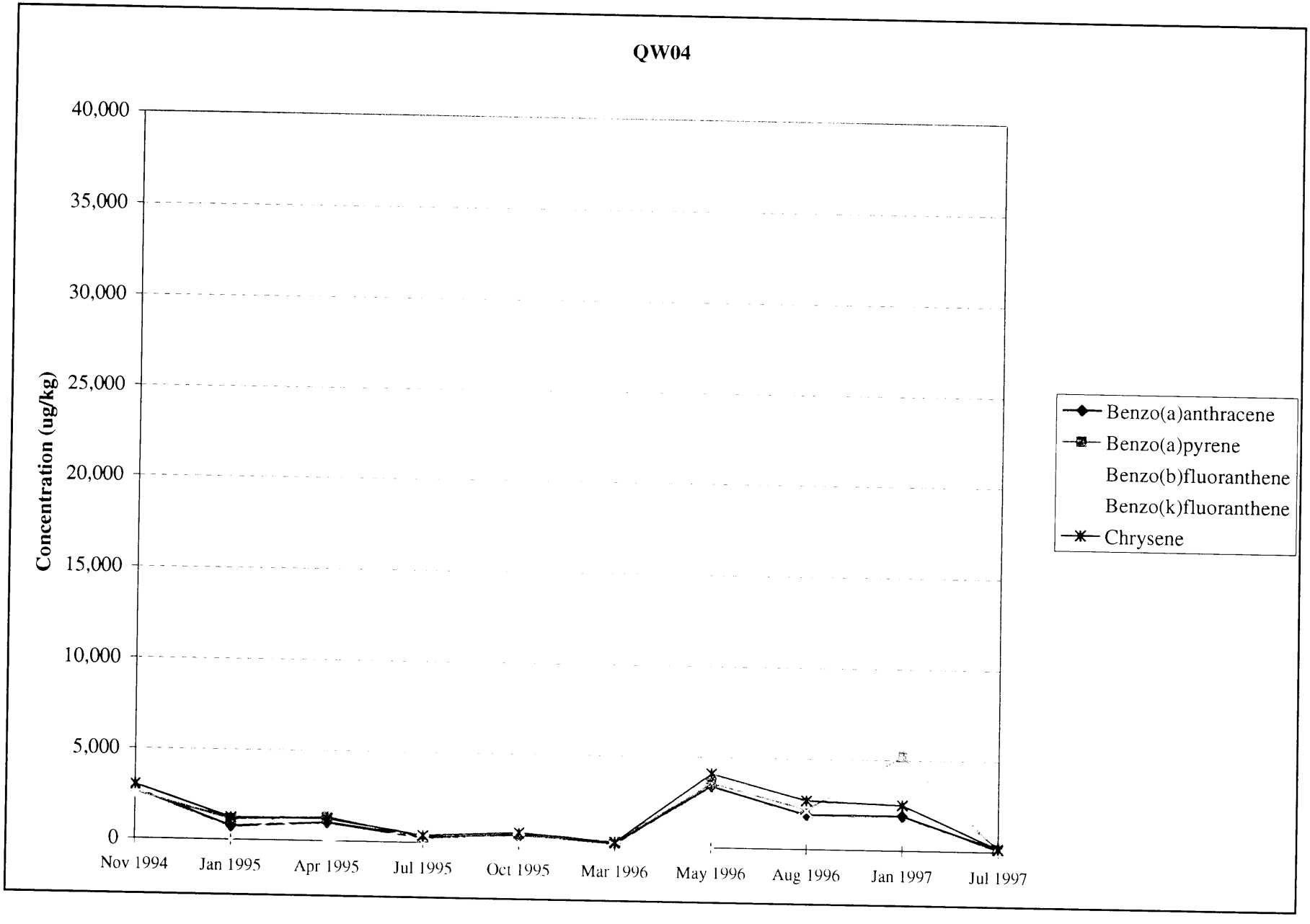


FIGURE 5-2o
TEMPORAL SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

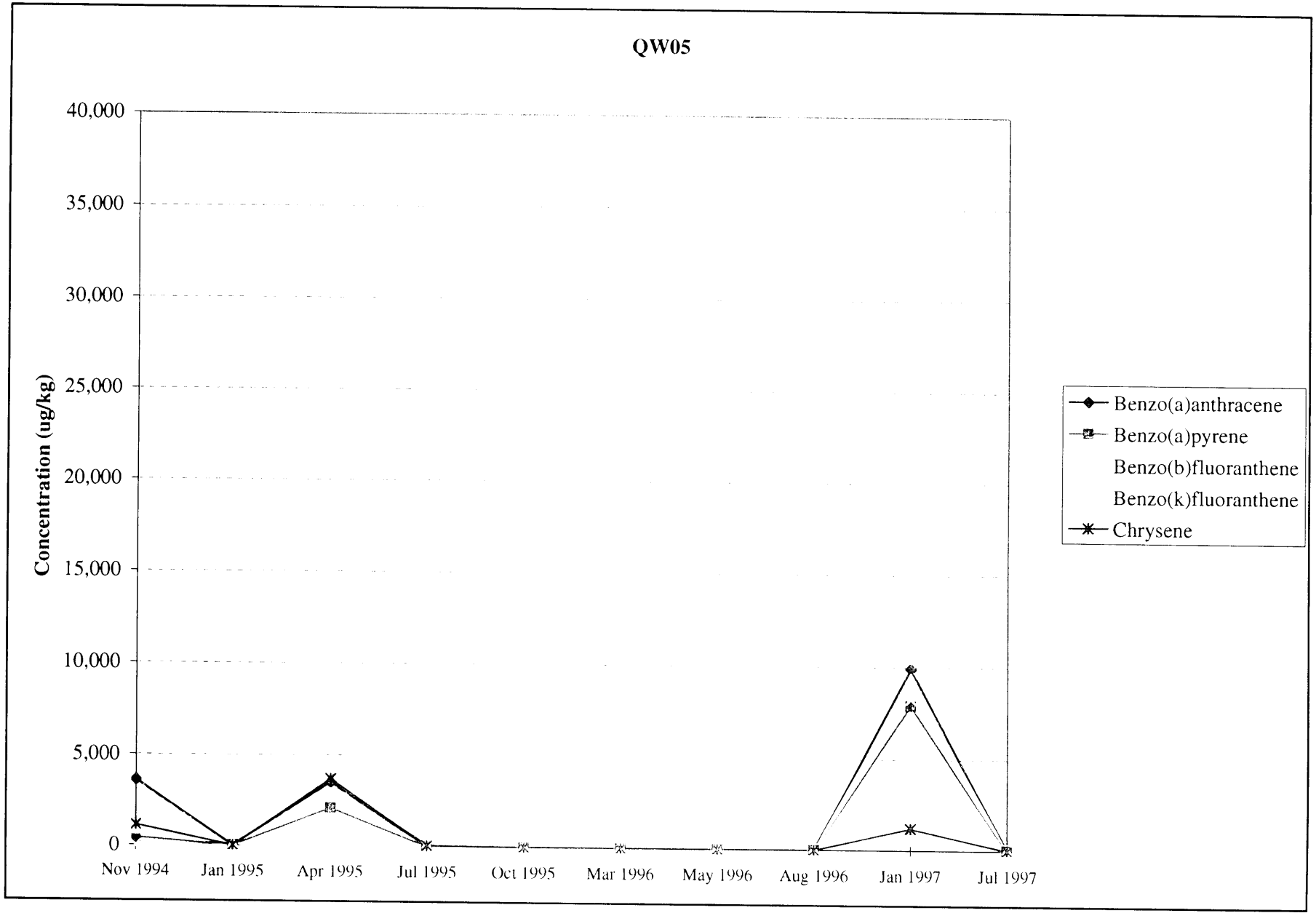


FIGURE 5-2p
TEMPORAL SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

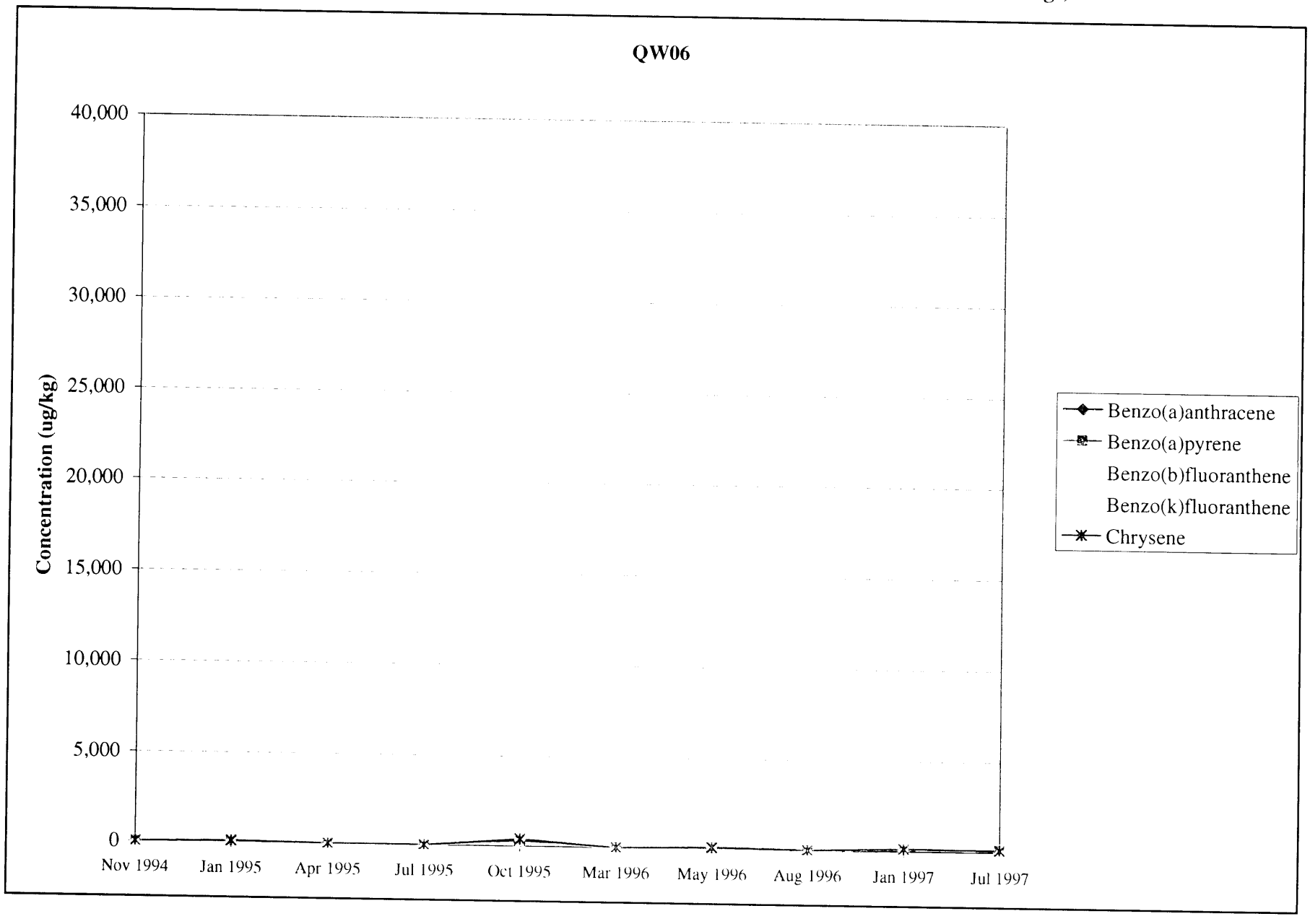


FIGURE 5-3a

EAST SOLIDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

1Qtr1Yr - November 1994

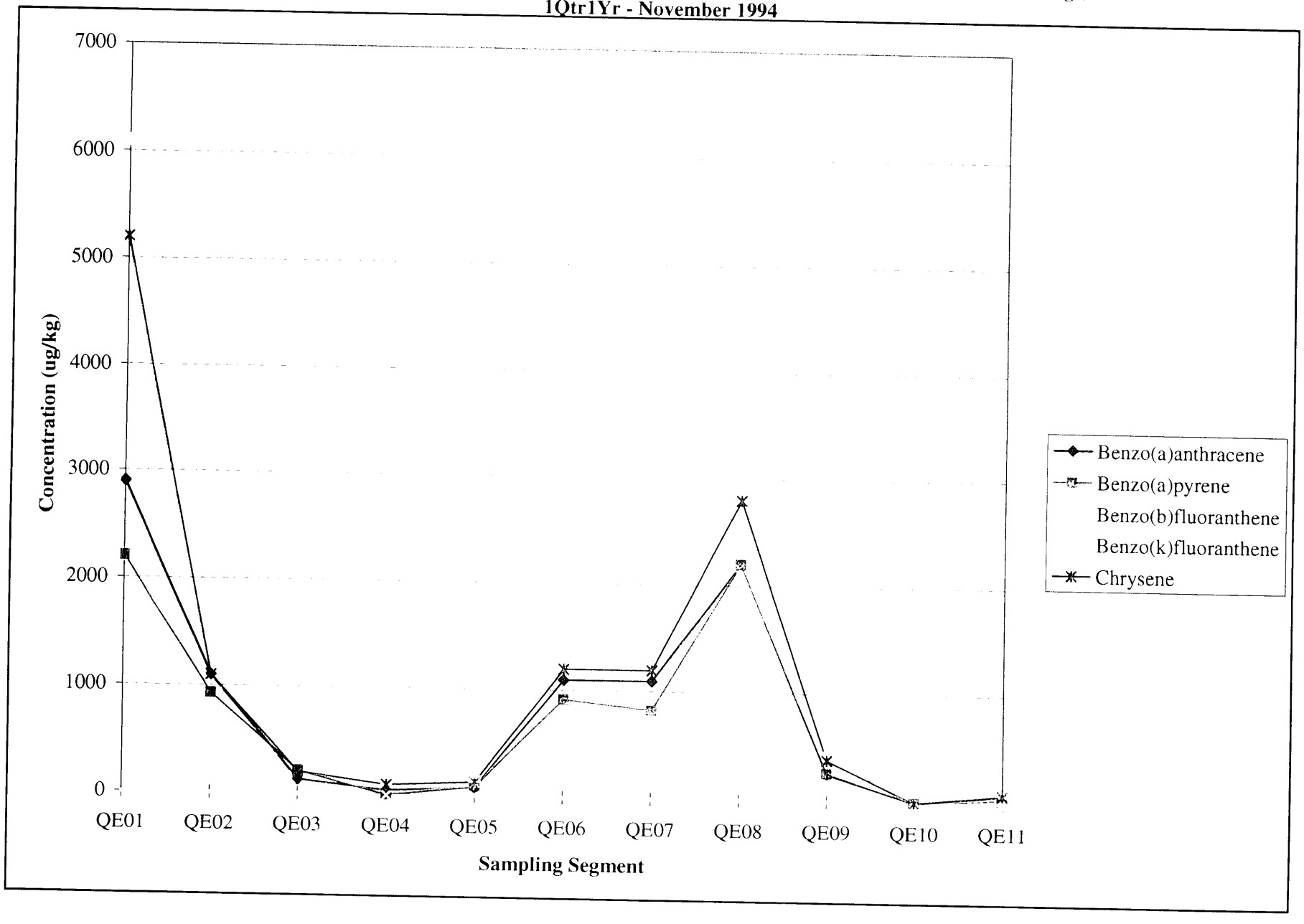


TABLE 5-3b

EAST SOLDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

2Qtr1Yr - January 1995

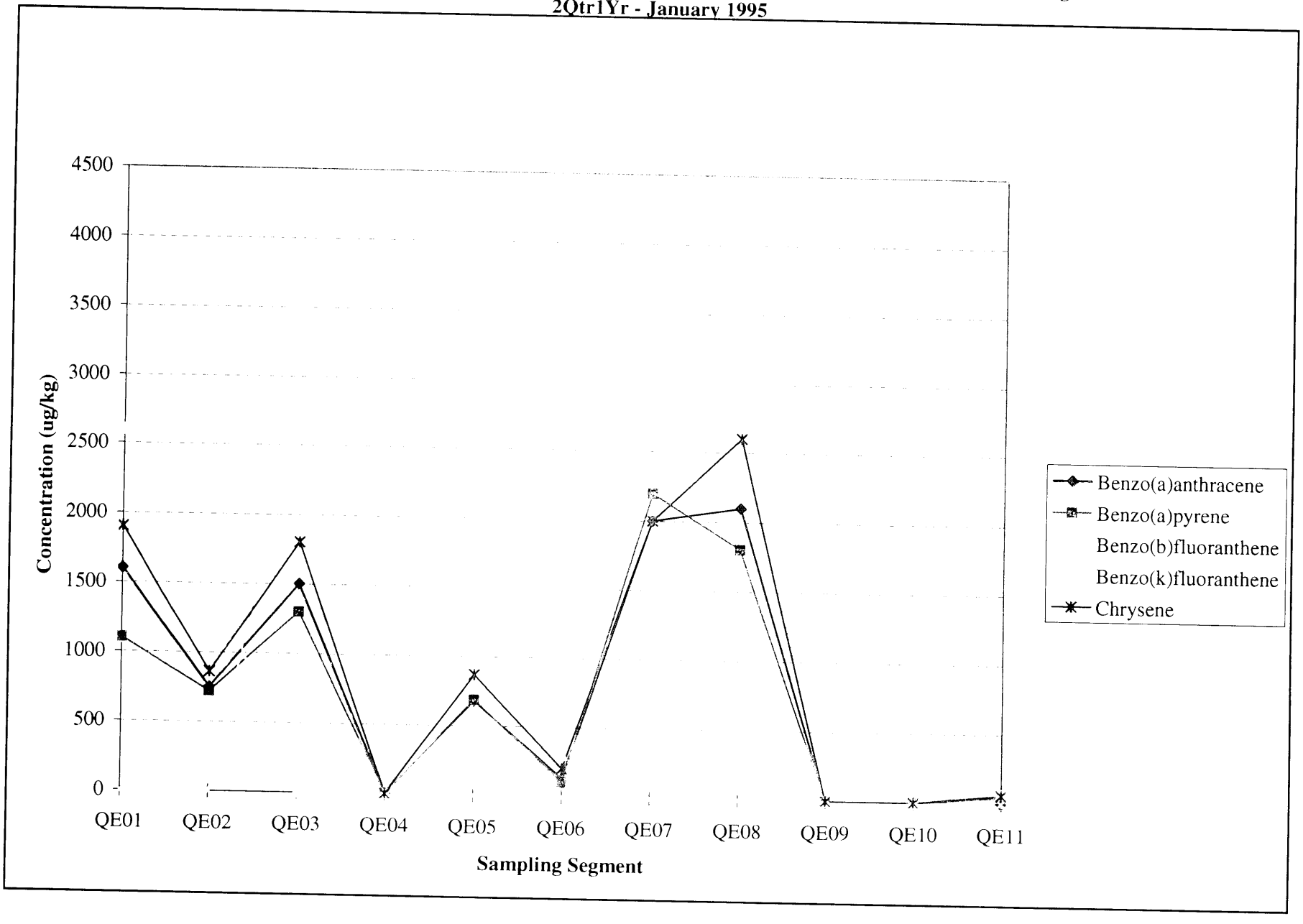


FIGURE 5-3c

EAST SOLDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

3Qtr1Yr - April 1995

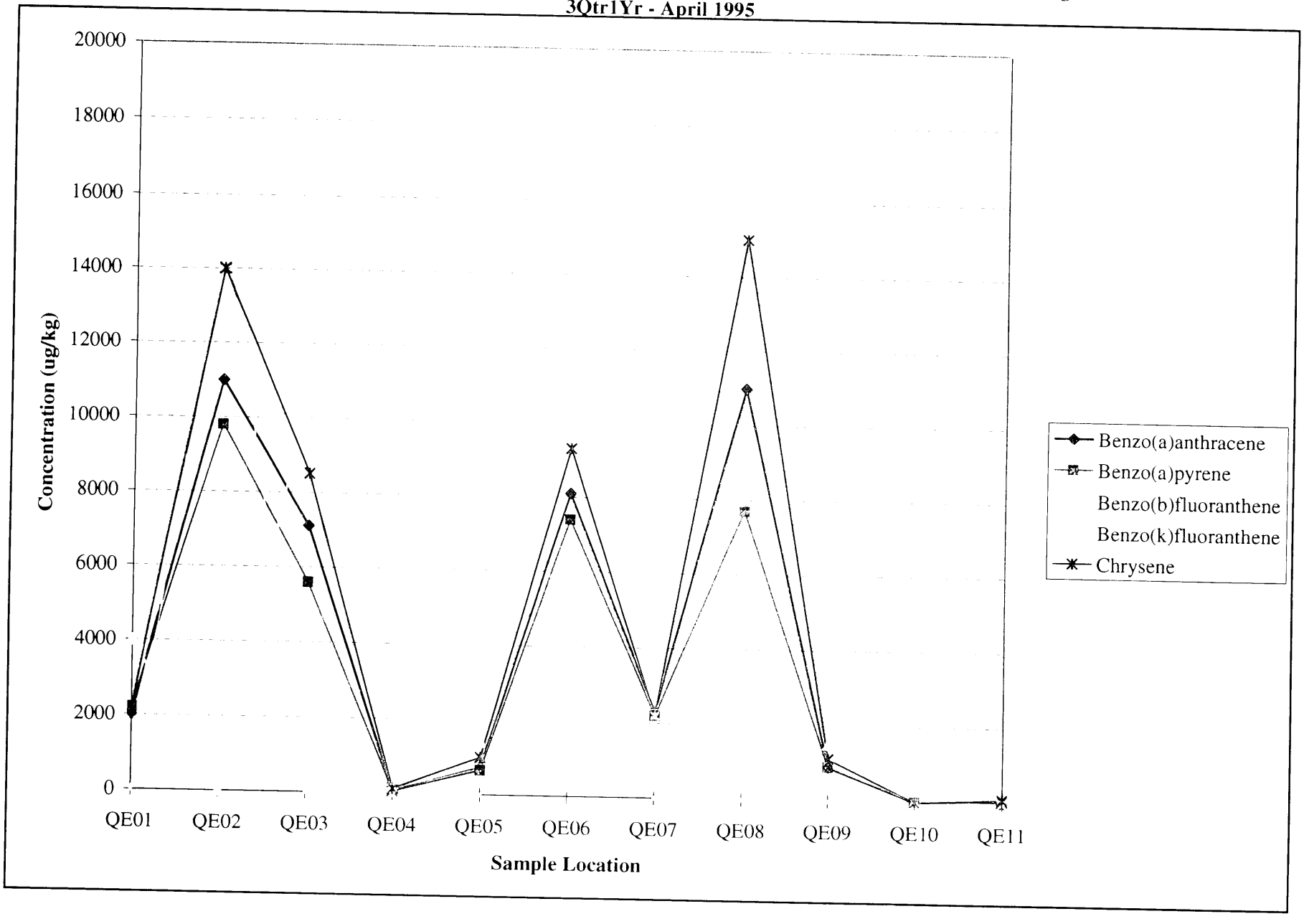


FIGURE 5-3d
EAST SOLDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)
4Qtr1Yr - July 1995

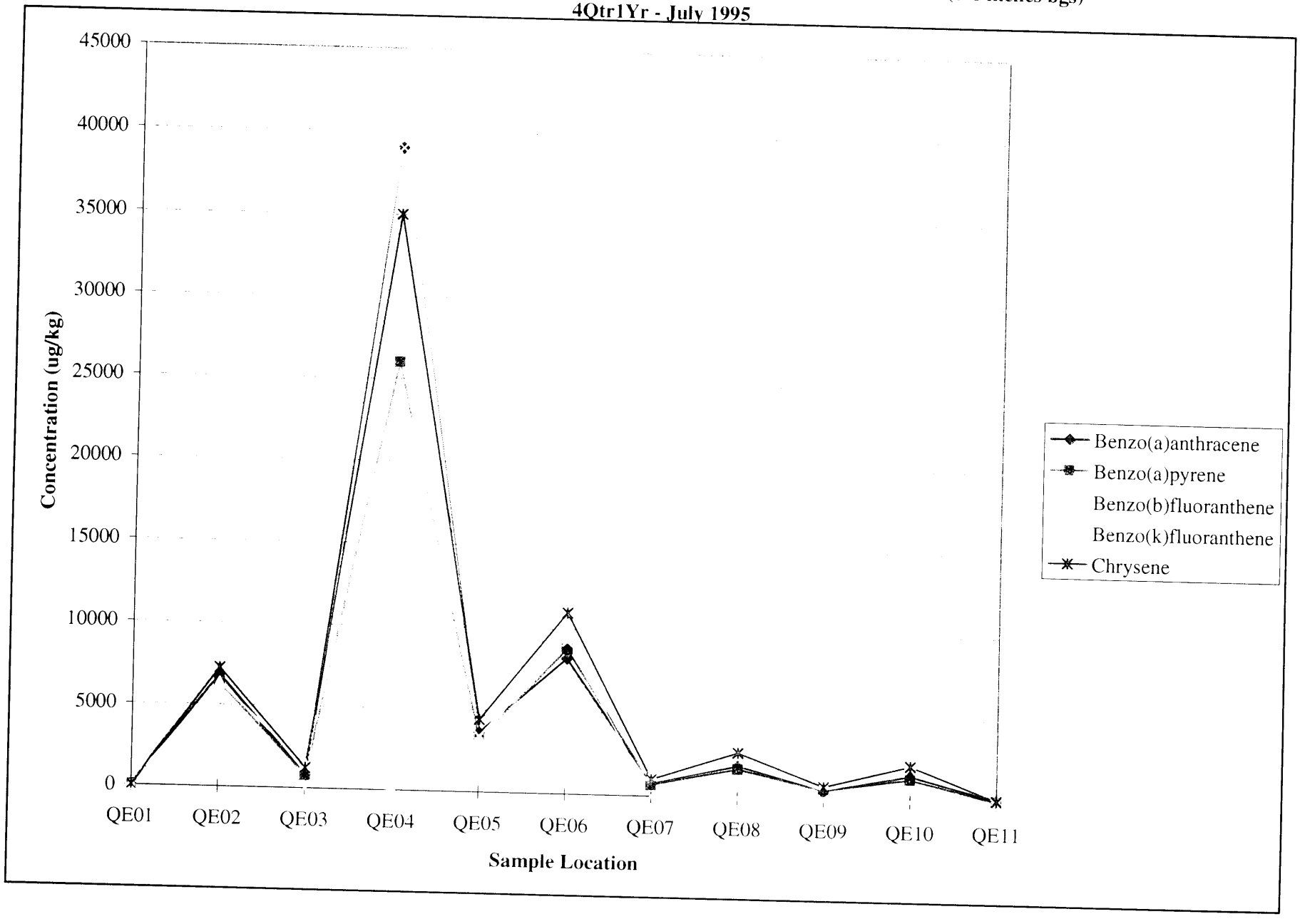


FIGURE 5-3e

EAST SOLDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

1Qtr2Yr - October 1995

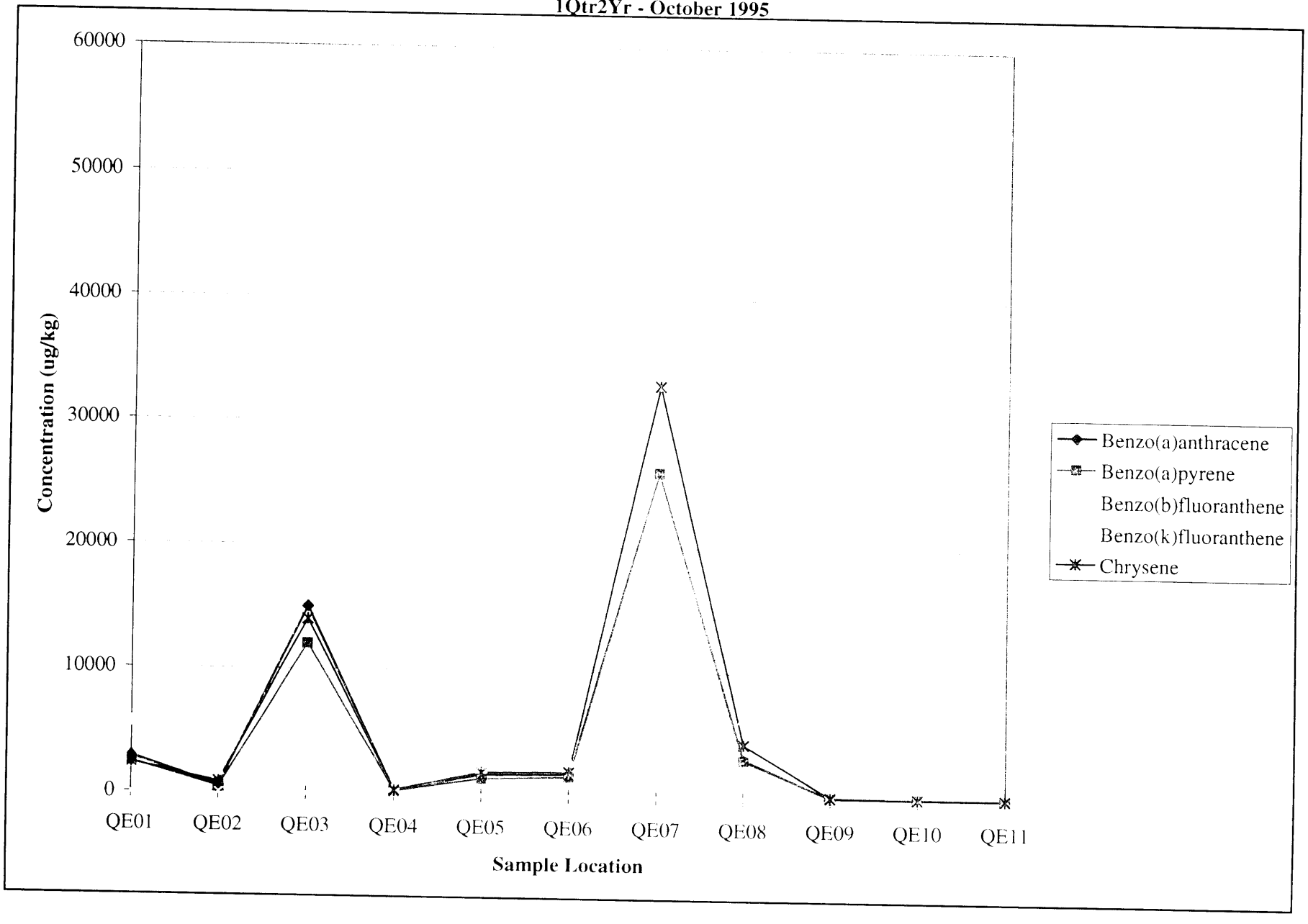


FIGURE 5-3f

EAST SOLDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

2Qtr2Yr - March 1996

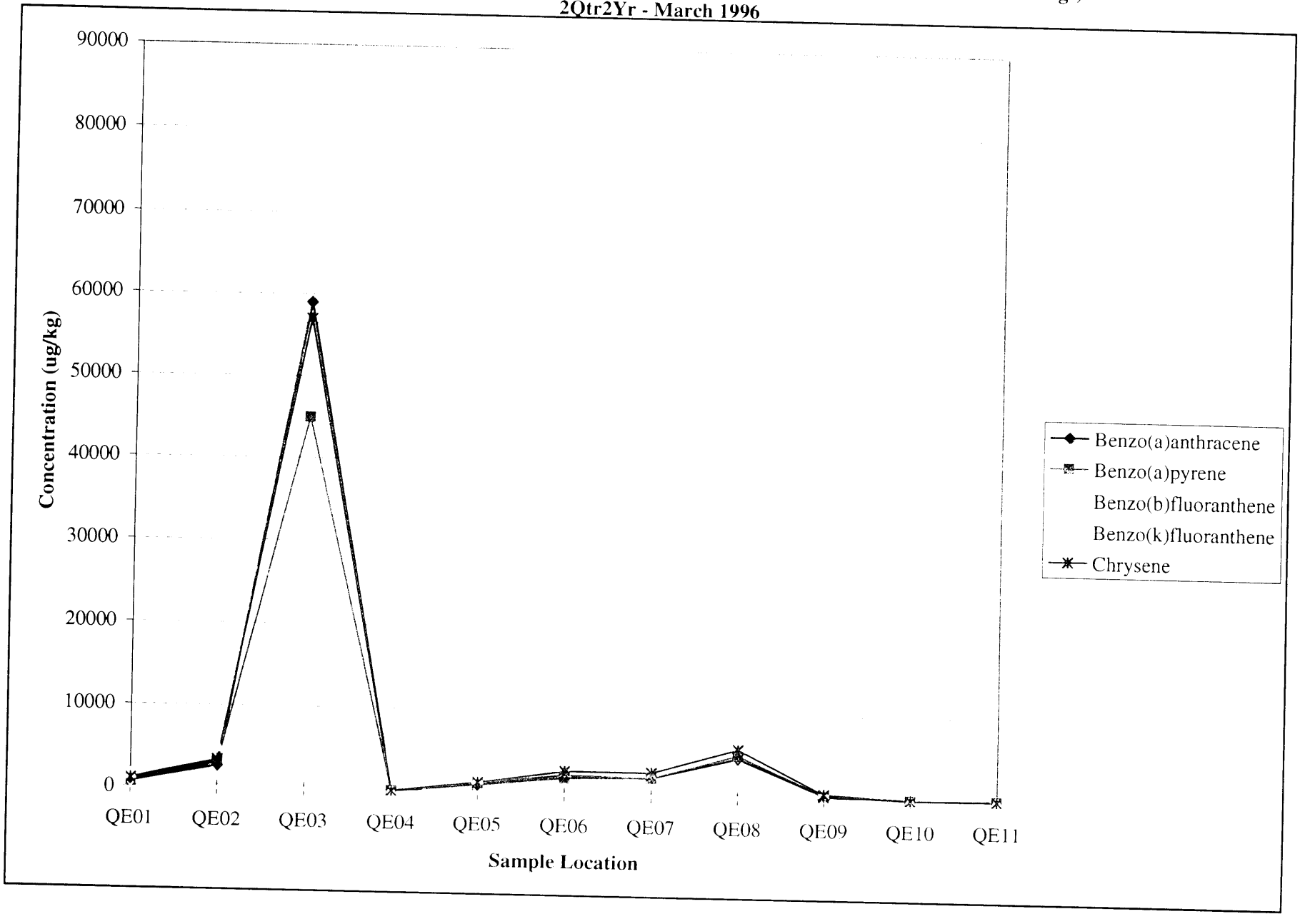


FIGURE 5-3g

EAST SOLDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

3Qtr2Yr - May 1996

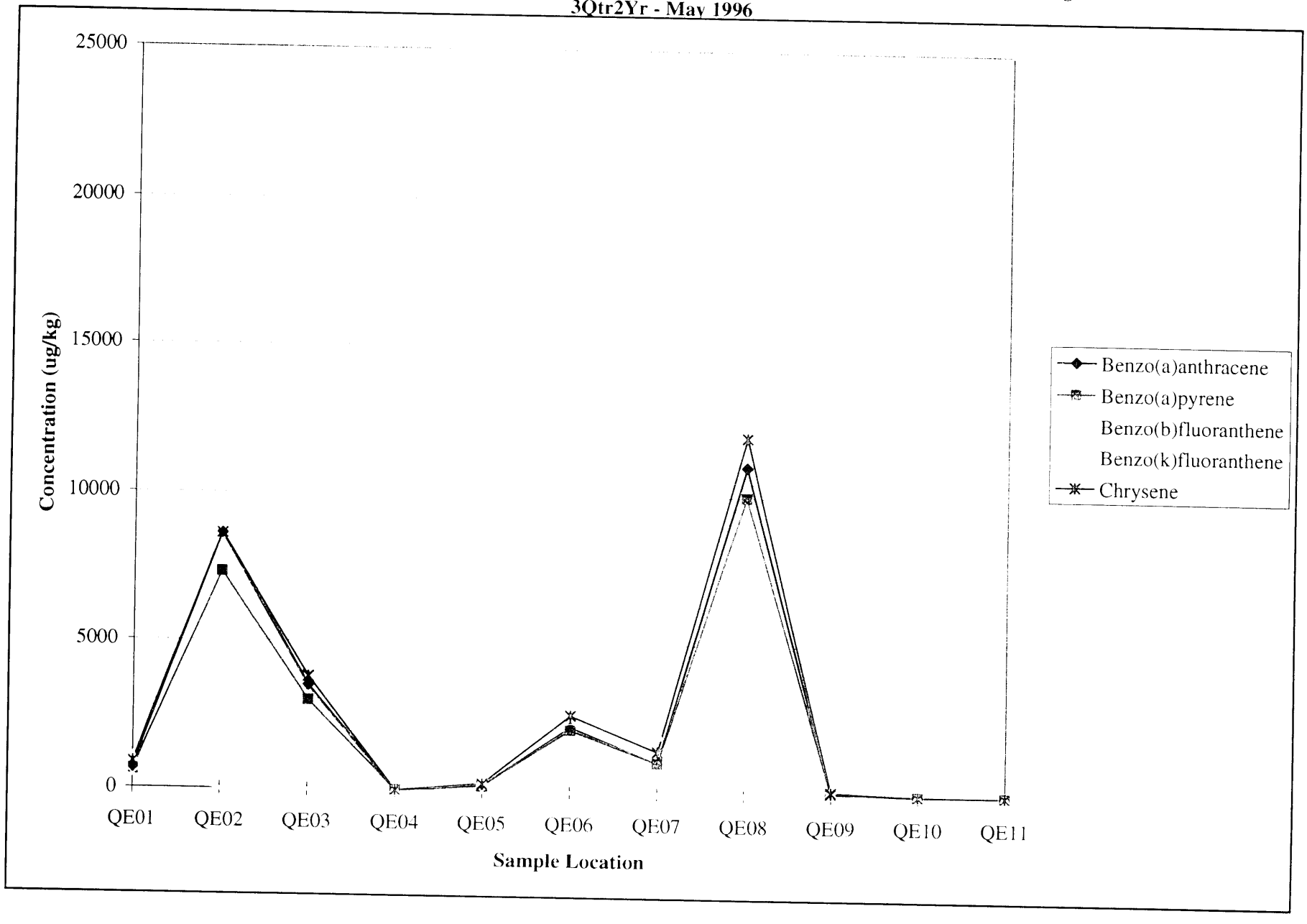


FIGURE 5-3h

EAST SOLDIERCREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

4Qtr2Yr - August 1996

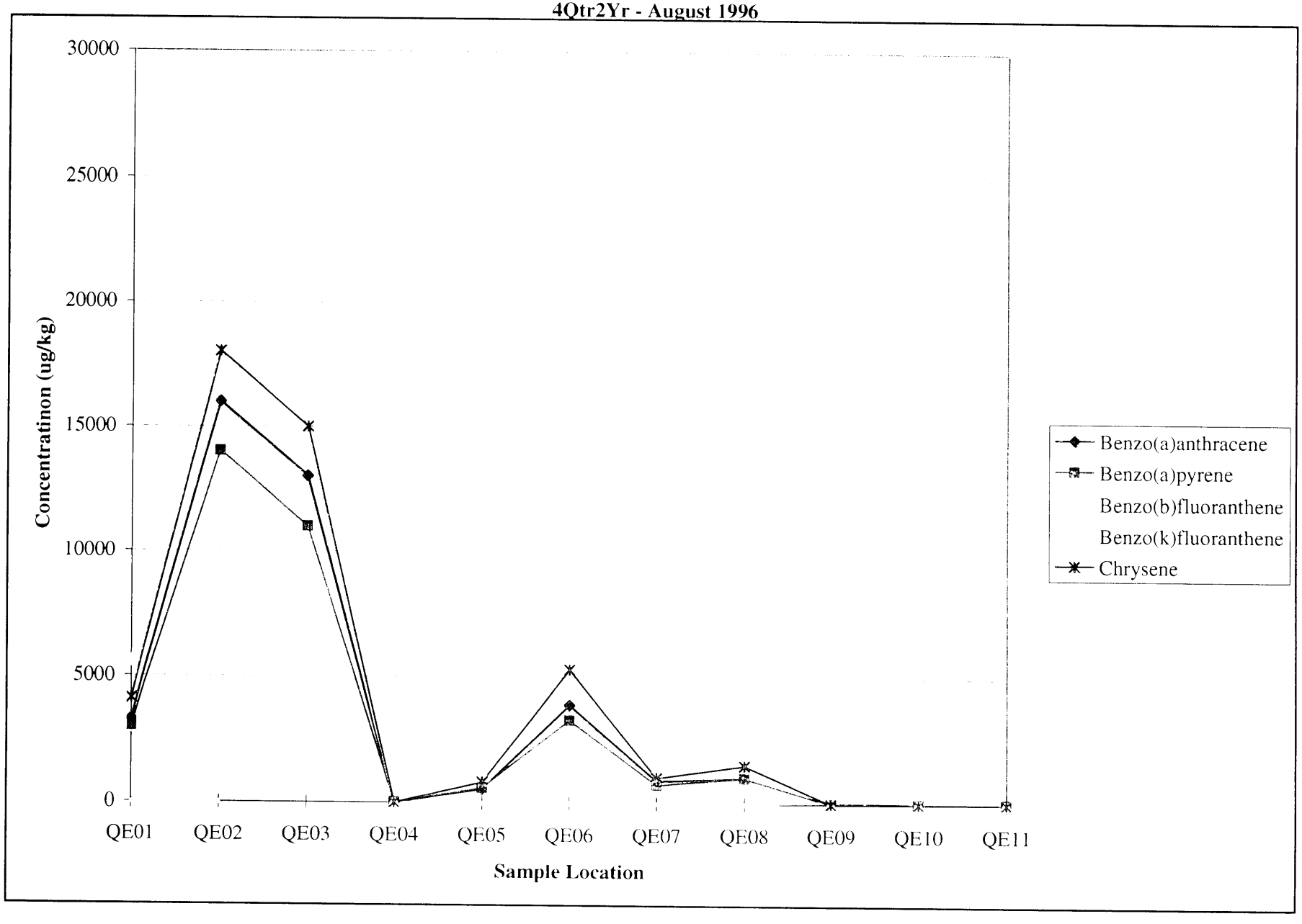


FIGURE 5-3i

EAST SOLDIERCREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

1Evnt3Yr - January 1997

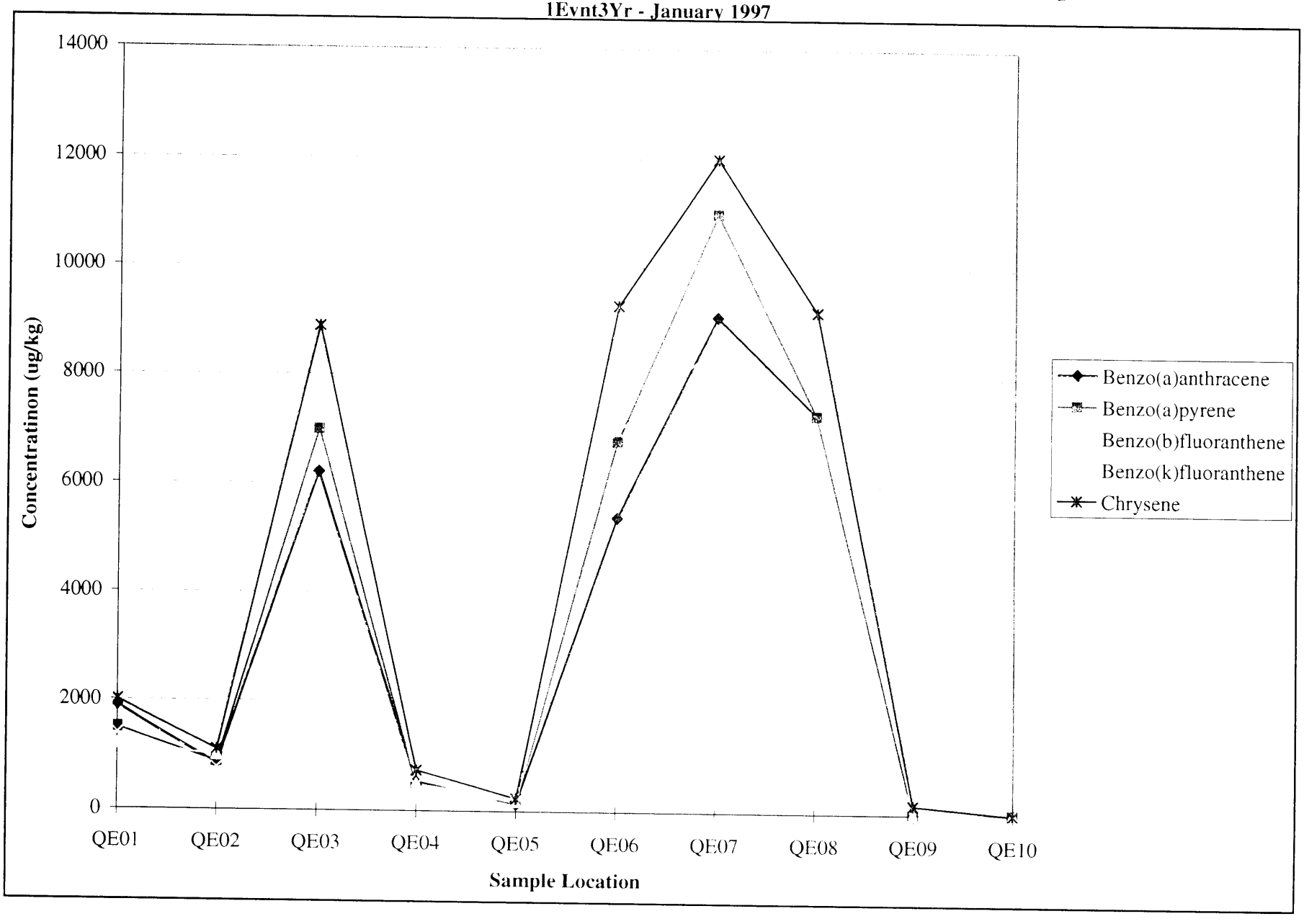


FIGURE 5-3j
EAST SOLDIERCREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)
2Evnt3Yr - July 1997

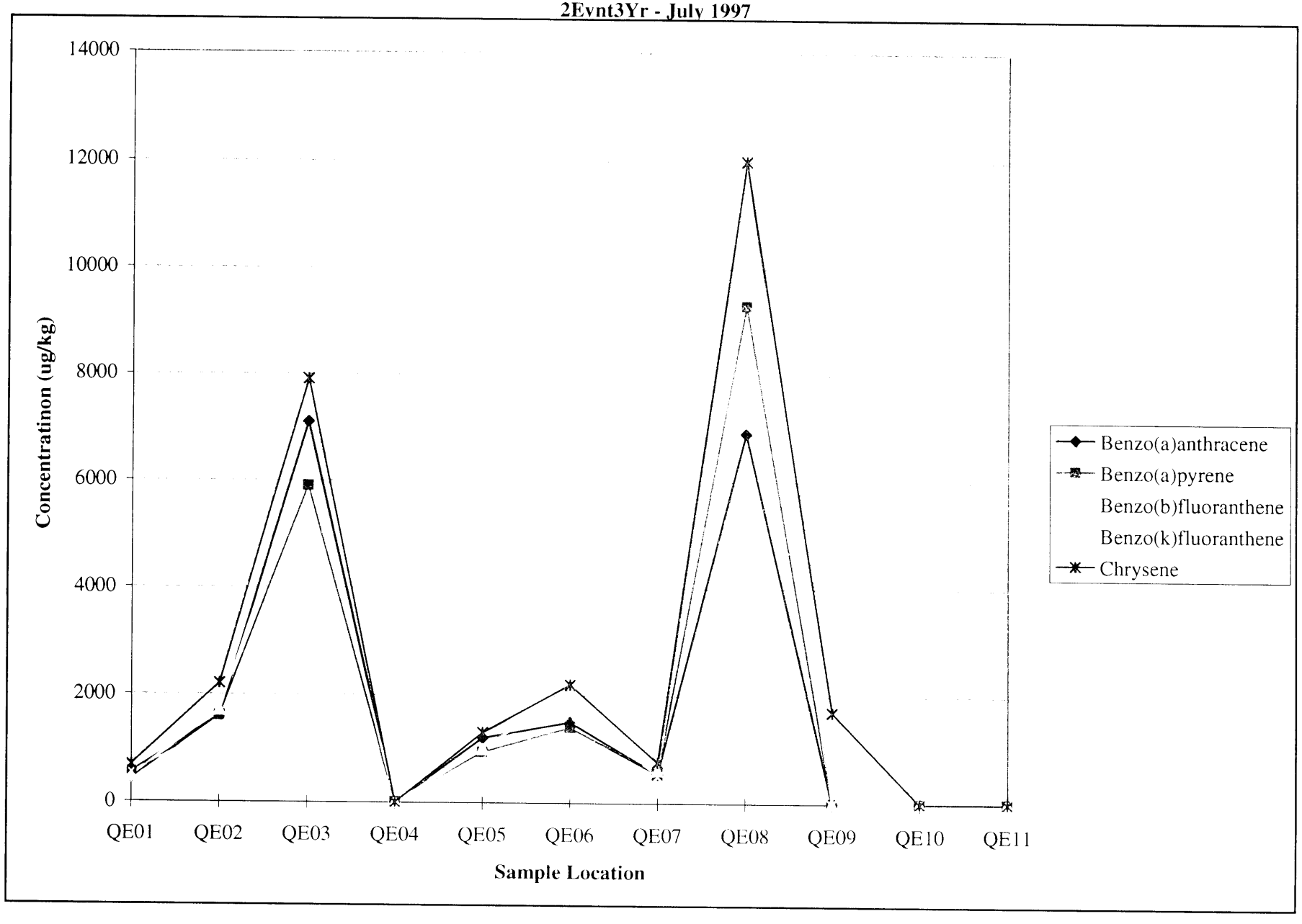


FIGURE 5-4a
WEST SOLDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)
1Qtr1Yr - November 1994

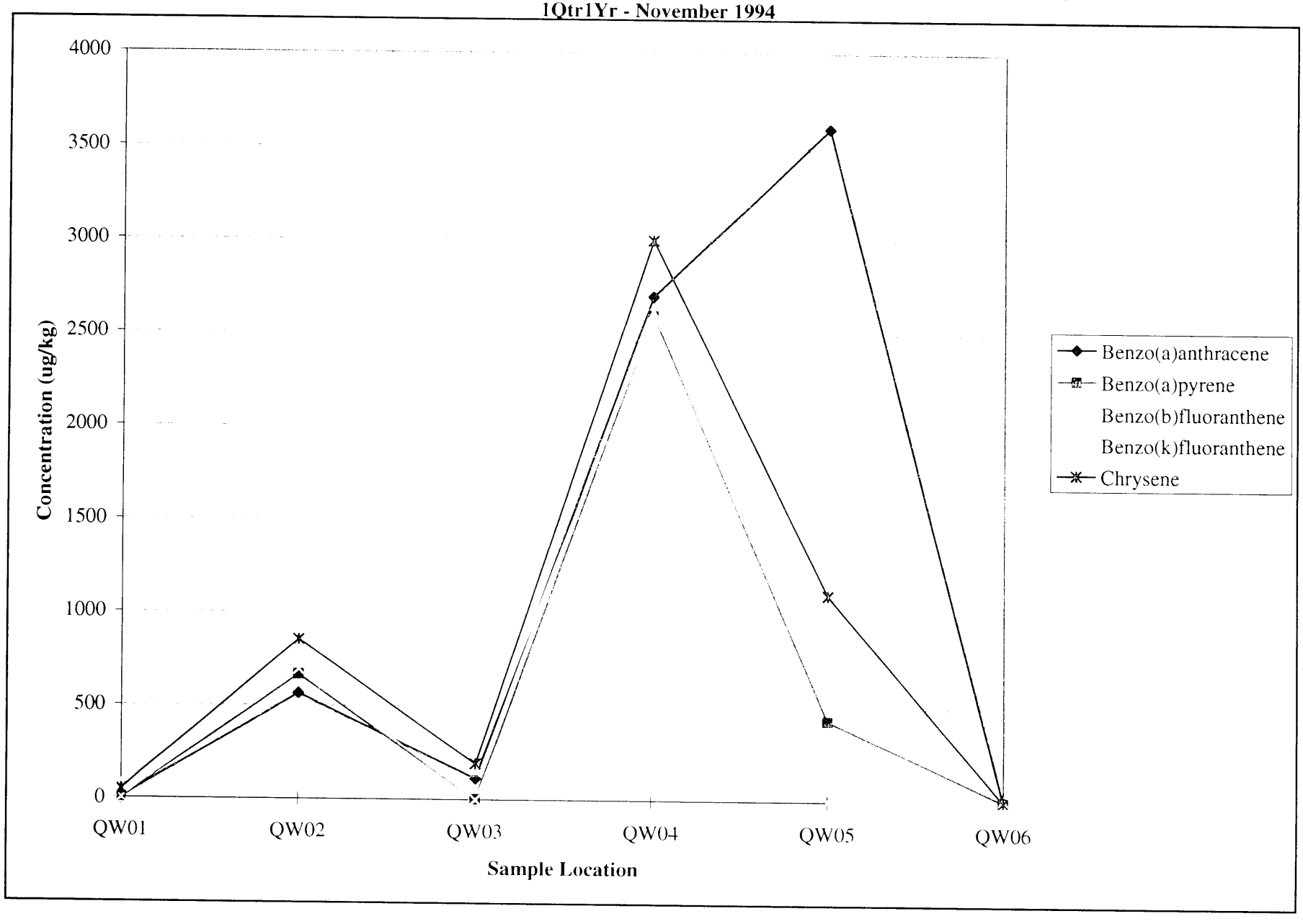


FIGURE 5-4b
WEST SOLDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)
2Qtr1Yr - January 1995

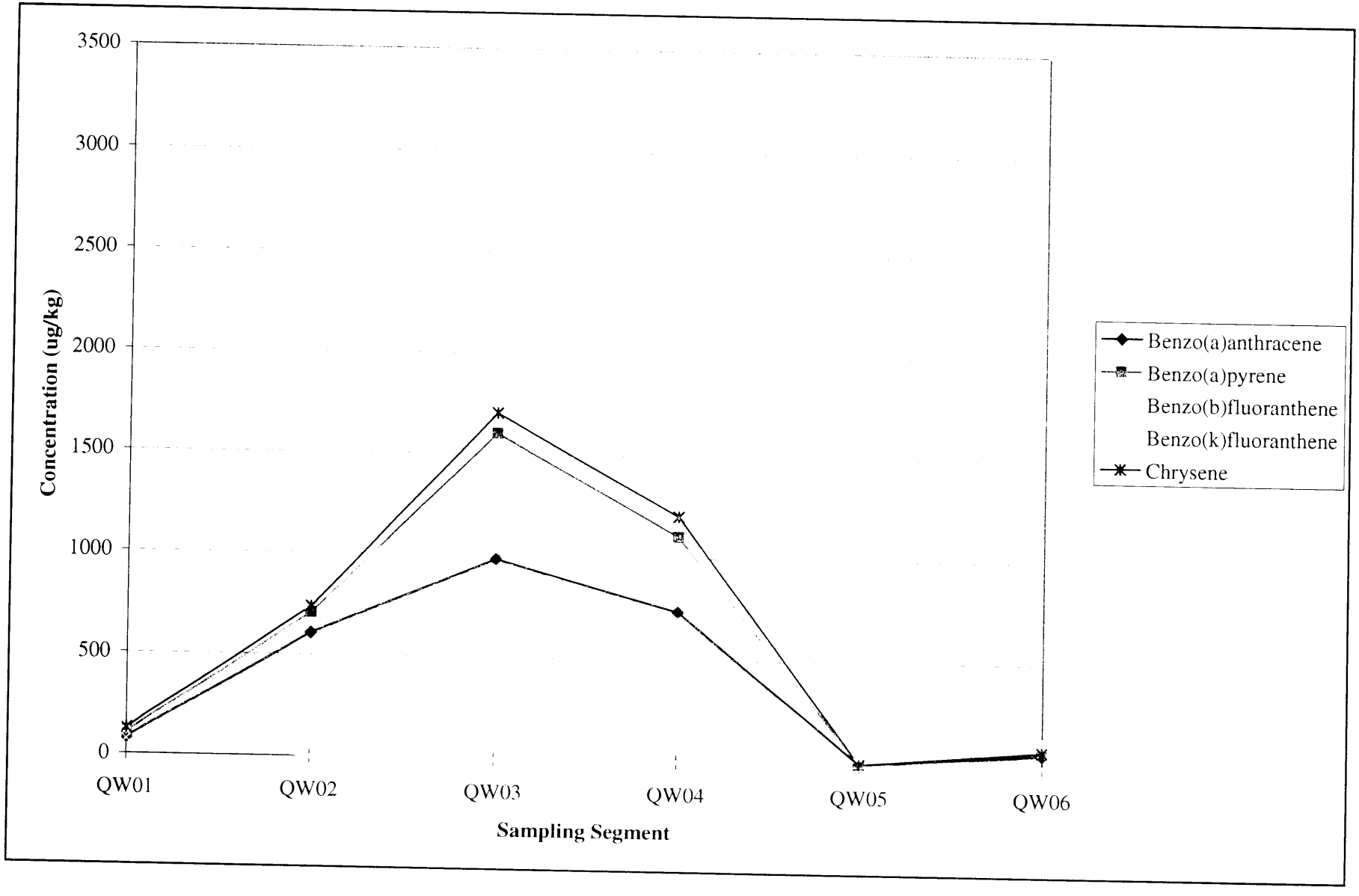


FIGURE 5-4c

WEST SOLDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

3Qtr1Yr - April 1995

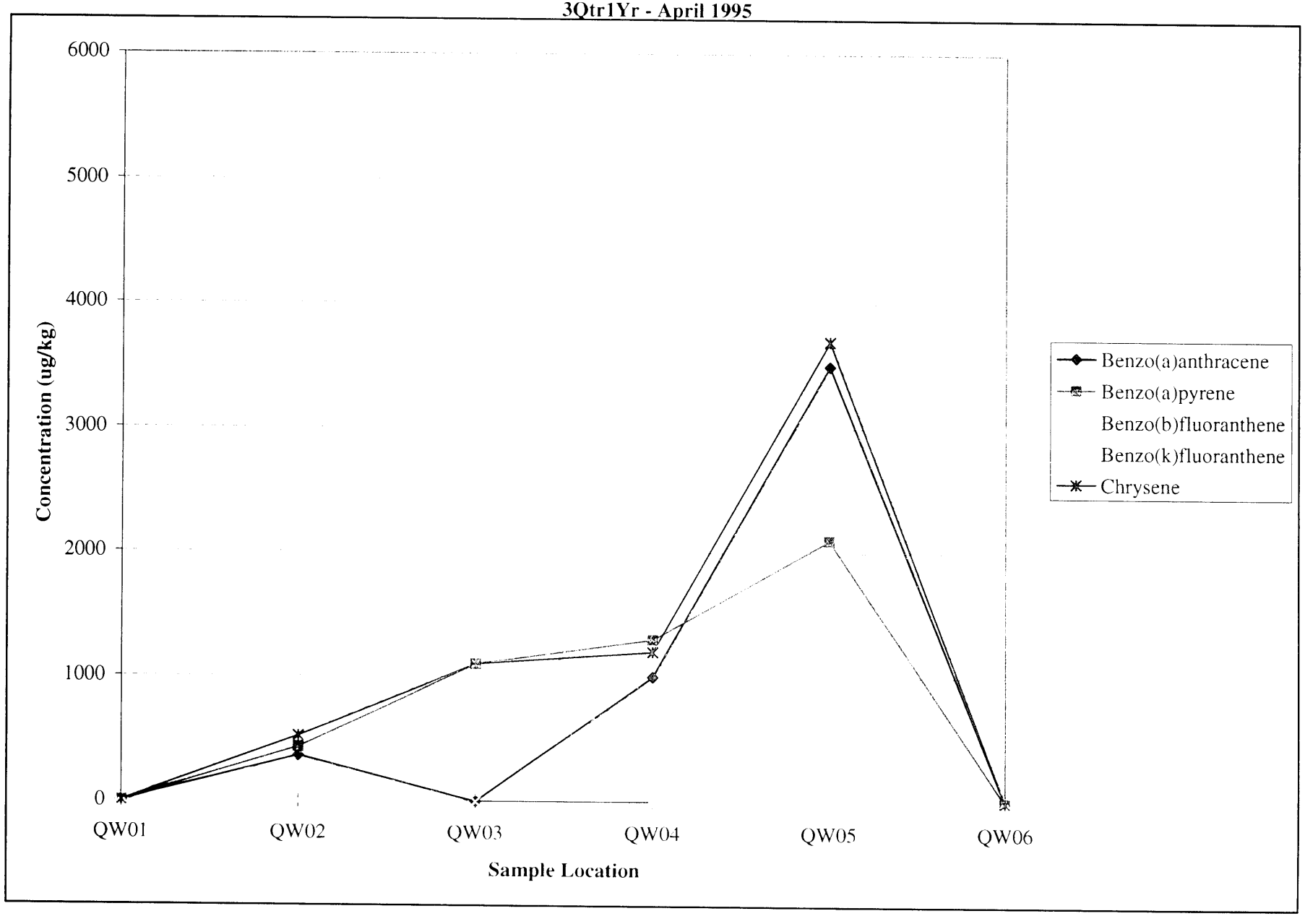


FIGURE 5-4d

WEST SOLDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

4Qtr1Yr - July 1995

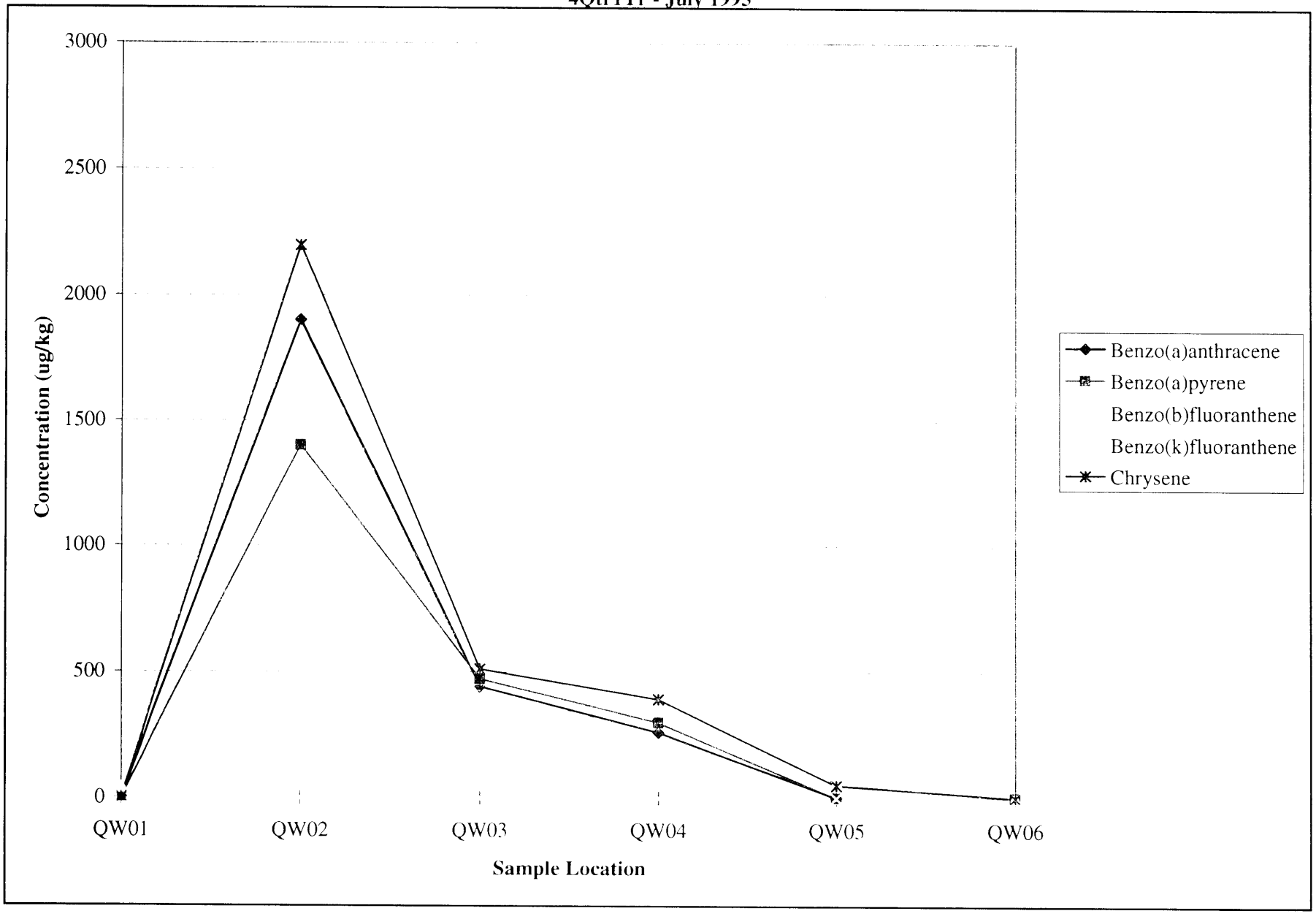


FIGURE 5-4e

WEST SOLDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)

1Qtr2Yr - October 1995

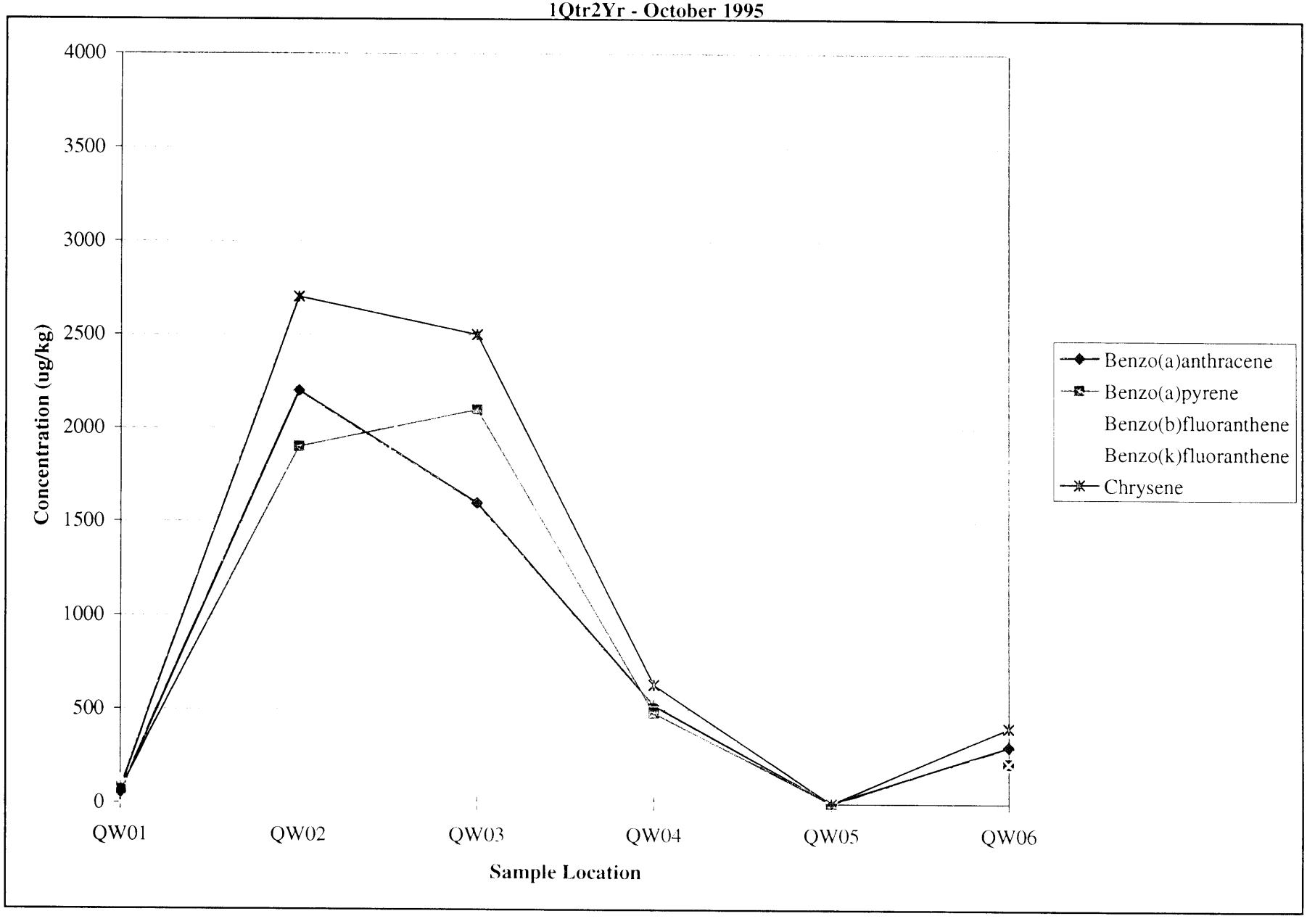


FIGURE 5-4f
WEST SOLDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)
2Qtr2Yr - March 1996

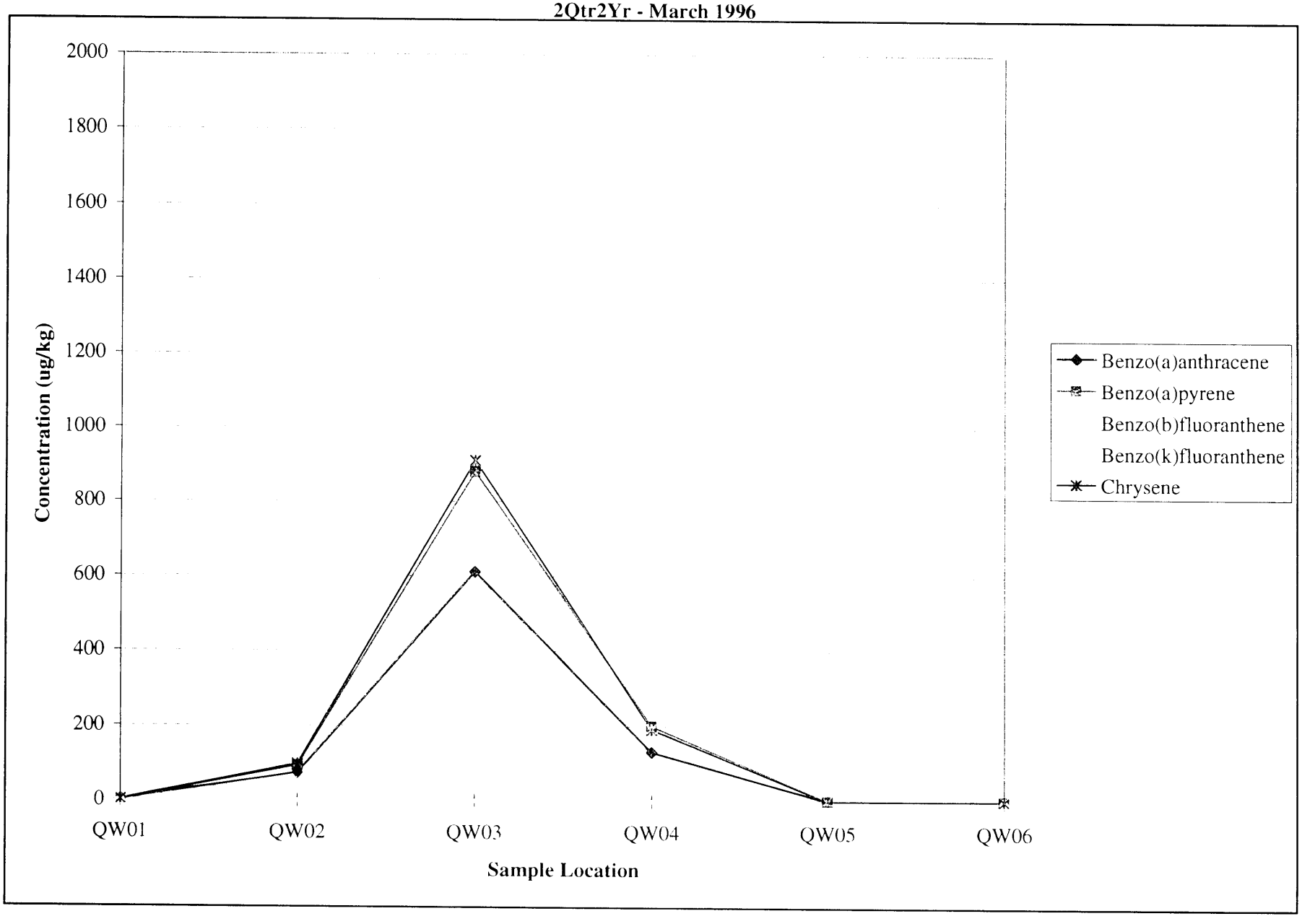


FIGURE 5-4g
WEST SOLDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)
3Qtr2Yr - May 1996

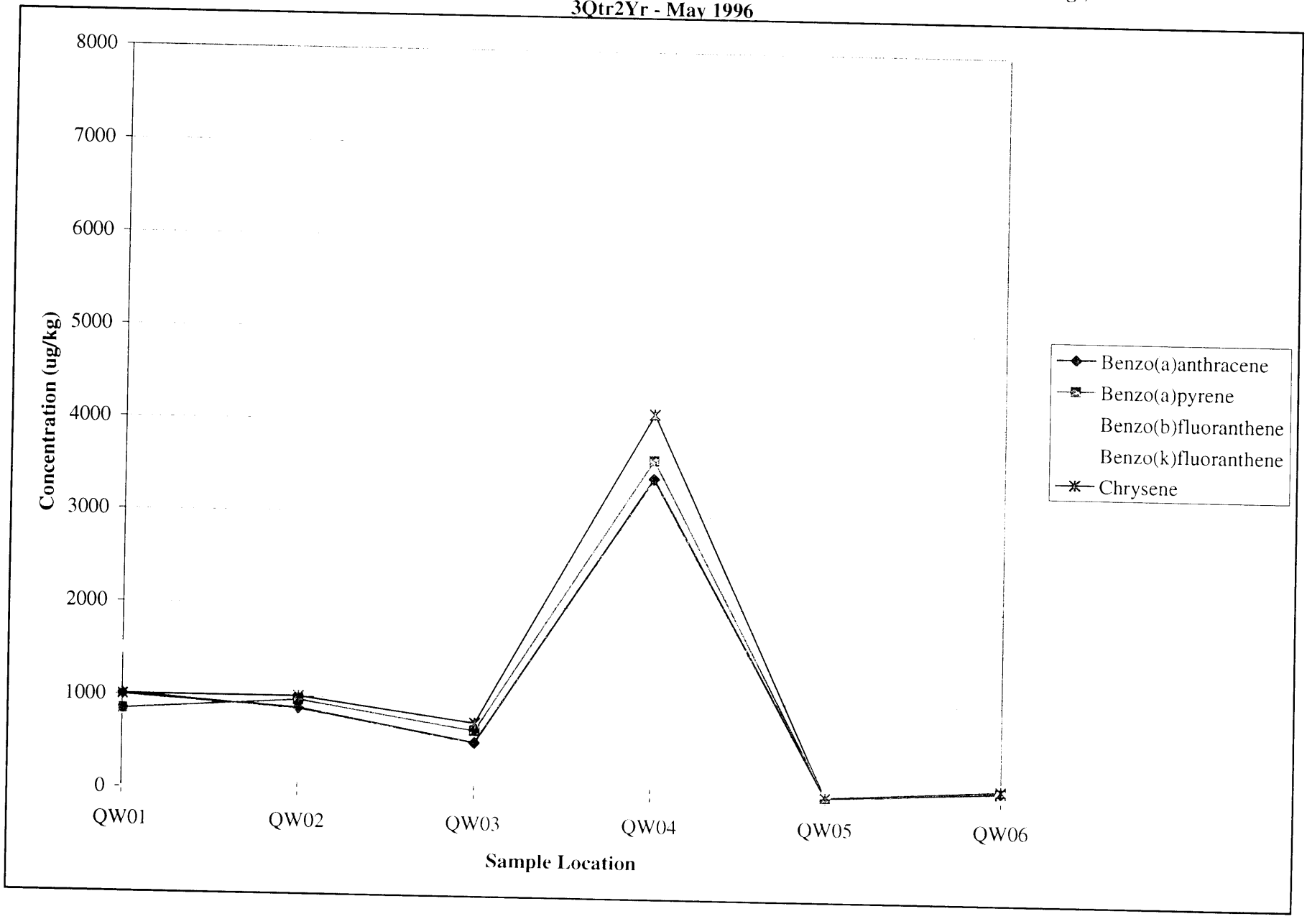


FIGURE 5-4h
WEST SOLDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)
4Qtr2Yr - Aug 1996

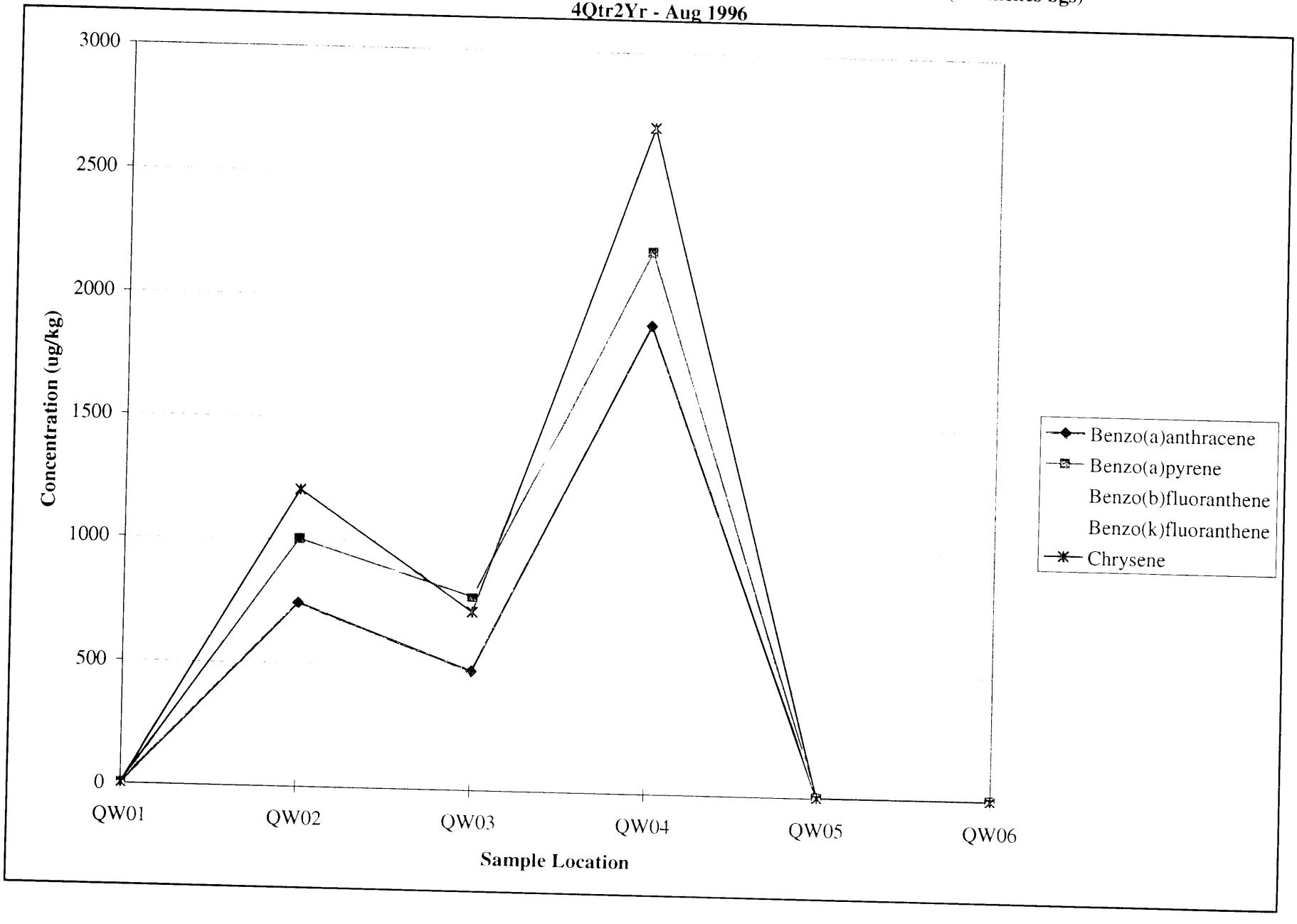


FIGURE 5-4i
WEST SOLDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)
1Evnt3Yr - Jan 1997

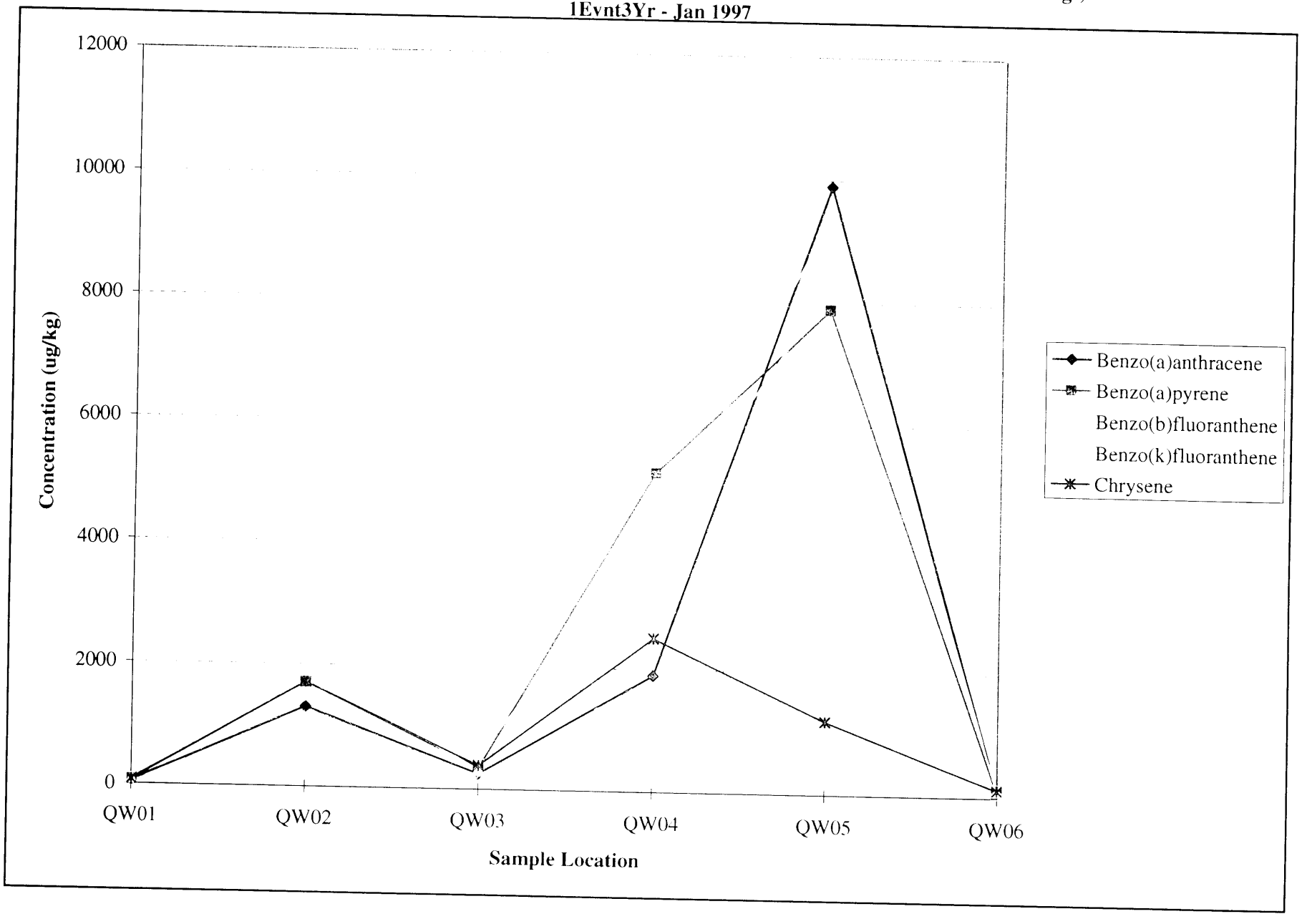
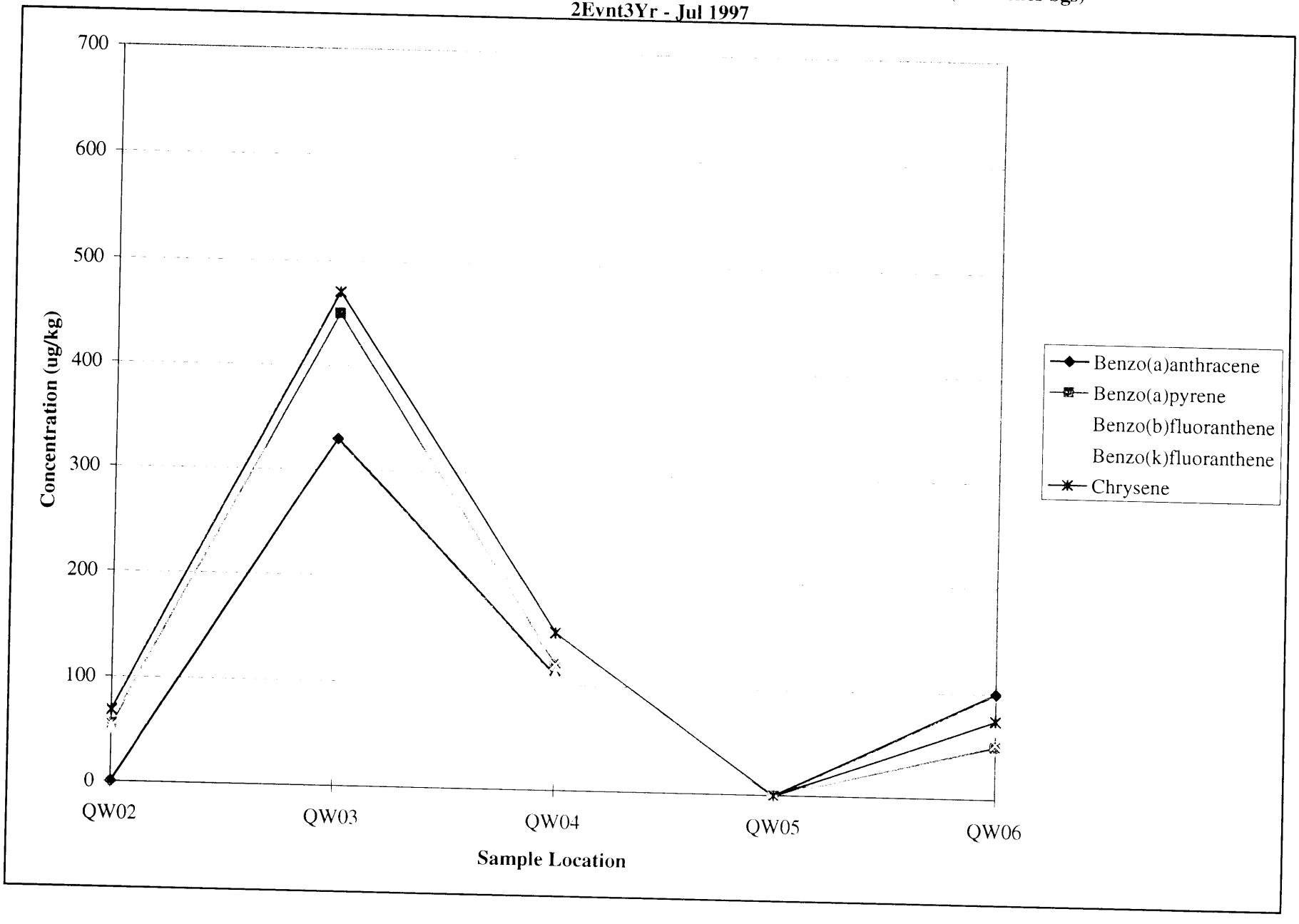


FIGURE 5-4j
WEST SOLDIER CREEK SEDIMENT PAH CONCENTRATION GRADIENT (0-6 inches bgs)
2Evnt3Yr - Jul 1997



6.0
CONCLUSIONS

The following discussion presents a summary of screening criteria exceedances during the third year of monitoring. The PAHs benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, and chrysene, exceeded the BHRA screening criteria in sediments during both monitoring events. Benzo(a)pyrene exceeded the HHRA 10^{-5} screening in one sample from 1Evnt3Yr monitoring event. Benzo(a)pyrene, benzo(b)fluoranthene, and dibenz(a,h)anthracene exceeded the HHRA I 10^{-6} screening criteria. Based on the ROD, exceedance of these 10^{-5} and 10^{-6} screening criteria may potentially indicate a need to evaluate if the exposure is unacceptable.

Sediment analyte concentrations from the third year of monitoring did not exceed the 10^{-4} screening criteria set forth in the BHRA and the HHRA I. However, at location QW03 the non-carcinogenic screening criteria for aroclor 1254 was exceeded.

Due to the sampling methodology, care must be taken when drawing inferences on temporal trends of compound concentrations. However, several trends in the detected analytes from sediment samples appear to be present.

- The detected PAH concentrations in the sediment appear to follow the same trend (e.g., an increase in one PAH compound is associated with increases in the other detected PAH compounds).

- The sampling segment with the highest PAH concentrations in the sediment varies between monitoring events. This relationship suggests that multiple origins for PAHs could exist.

- Analyte concentrations are seen to decrease off-base as compared to on-base.

Surface water analyte concentrations from the third year of monitoring did not exceed any of the screening criteria set forth in the BHRA and the HHRA I.

The results of the HHRA III were compared to those presented in the HHRA I and HHRA II. The results of the comparison between the three HHRAs showed no dramatic changes. Although the off-base East Soldier Creek cancer risks show a steady decline from HHRA I to HHRA III.

Despite slight differences in approach between the HHRAs and the BHRA, all risk assessments have concluded that there are no unacceptable cancer risks or non-carcinogenic hazards associated with exposure to East or West Soldier Creeks for any on-base or off-base populations, under current of future stream use conditions. Thus no remedial action appears to be warranted based on risks to human health.

7.0
REFERENCES

Black and Veatch Waste Science Technology (B&V). 1993a. Baseline Risk Assessment for Tinker Air Force Base, Soldier Creek. Report for Tinker Air Force Base, Oklahoma City, OK.

Black and Veatch Waste Science Technology (B&V). 1993b. Record of Decision for Tinker Air Force Base, Soldier Creek. Report for Tinker Air Force Base, Oklahoma City, OK.

Black and Veatch Waste Science Technology (B&V). 1993c. Final Remedial Investigation Report, Tinker Air Force Base, Soldier Creek, RI/FS. Report for Tinker Air Force Base, Oklahoma City, OK.

Brown and Root. 1996. Basewide Environmental Monitoring and Well Sampling and Water Level Measurements. Report for Tinker Air Force Base, Oklahoma City, Oklahoma. January 1996.

Bureau of National Affairs (BNA). 1994. Oklahoma Groundwater Quality Standards. Bureau of National Affairs.

NUS Corporation (NUS). 1989. Final Storm Sewer Investigation for Soldier Creek. Report for Tinker Air Force Base, Oklahoma City, OK. October 1989.

Parsons Engineering Science (PES). 1995. Tinker Air Force Base Soldier Creek/Off-Base Groundwater Operable Unit Remedial Investigation. Internal Draft. Report for Tinker Air Force Base, Oklahoma City, OK. July 1995.

United States Department of Health and Human Services (USDHHS). 1990. Toxicological Profiles for Polycyclic Aromatic Hydrocarbons. Publication Number PB91-181537. December 1990.

United States Environmental Protection Agency (EPA). 1992. Test Methods for Evaluating Solid Waste. SW-846, Revision 1. July 1992.

United States Environmental Protection Agency (EPA). 1994a. EPA Contract Laboratory Program National Functional Guidelines for Organic Data Review. February 1994 Revision.

United States Environmental Protection Agency (EPA). 1994b. Drinking Water Regulations and Health Advisories, EPA 822-R-94-001. U.S. EPA Office of Water. May 1994.

United States Geological Survey (USGS). 1984. Techniques of Water-Resources Investigations of the United States Geological Survey, Discharge Measurements at Gaging Stations. Book 3, Chapter A8.

Woodward-Clyde Federal Services (WCFS). 1994. Final Workplans for Long-Term Monitoring and Ecological Assessment of Soldier Creek Tinker Air Force Base. Report for Tinker Air Force Base, Oklahoma City, Oklahoma. June 1994, revised December 1994.

Woodward-Clyde Federal Services (WCFS). 1996a. First Quarter Second Year Sampling Report, October 1995 Long-Term Monitoring of Soldier Creek, Tinker Air Force Base. Report for Tinker Air Force Base, Oklahoma City, Oklahoma. January 1996.

Woodward-Clyde Federal Services (WCFS). 1996b. Second Quarter Second Year Sampling Report, March 1996 Long-Term Monitoring of Soldier Creek, Tinker Air Force Base. Report for Tinker Air Force Base, Oklahoma City, Oklahoma. June 1996.

Woodward-Clyde Federal Services (WCFS). 1996c. Third Quarter Second Year Sampling Report, May 1996 Long-Term Monitoring of Soldier Creek, Tinker Air Force Base. Report for Tinker Air Force Base, Oklahoma City, Oklahoma. September 1996.

Woodward-Clyde Federal Services (WCFS). 1996d. Fourth Quarter Second Year Sampling Report, August 1996 Long-Term Monitoring of Soldier Creek, Tinker Air Force Base. Report for Tinker Air Force Base, Oklahoma City, Oklahoma. November 1996.

Woodward-Clyde Federal Services (WCFS). 1997a. Final Quarterly Monitoring Annual Report. Report for Tinker Air Force Base, Oklahoma City, Oklahoma. April 1997.

Woodward-Clyde Federal Services (WCFS). 1997b. Draft Second Year Quarterly Monitoring Annual Report. Report for Tinker Air Force Base, Oklahoma City, Oklahoma. June 1997.

Woodward-Clyde Federal Services (WCFS). 1997c. Final Ecological Assessment Report. Report for Tinker Air Force Base, Oklahoma City, Oklahoma. April 1997.

Woodward-Clyde Federal Services (WCFS). 1997d. First Event Third Year Sampling Report, January 1997, Long-Term Monitoring of Soldier Creek, Tinker Air Force Base. Report for Tinker Air Force Base, Oklahoma City, Oklahoma. April 1997.

Woodward-Clyde Federal Services (WCFS). 1997e. Second Event Third Year Sampling Report, July 1997, Long-Term Monitoring of Soldier Creek, Tinker Air Force Base. Report for Tinker Air Force Base, Oklahoma City, Oklahoma. November 1997.

APPENDIX A

HUMAN HEALTH RISK ASSESSMENT

TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES

LIST OF TABLES

LIST OF FIGURES

List Of Appendixes

EXECUTIVE SUMMARY

Evaluations of potential risks associated with Soldier Creek surface water and sediments at Tinker Air Force Base (AFB) located in Oklahoma City, Oklahoma, were previously performed by Black & Veatch (B&V) Waste Science Technology (B&V 1993) and Woodward-Clyde Federal Services (WCFS) (1996, 1997b). Soldier Creek sediments and surface water continue to be sampled as part of the long-term monitoring of Soldier Creek. The purpose of this risk assessment (RA) is to provide estimates on potential current and future risks based on current surface water and sediment contaminant concentrations, to compare the results with those of the two previous WCFS RAs to see if previous conclusions are still valid, to evaluate any potential trends associated with estimated risks, and to develop cleanup goals for stream sediments and surface water that are protective of human populations.

This RA was performed using guidelines provided in the Risk Assessment Guidance for Superfund - Part A [United States Environmental Protection Agency (USEPA) 1989a] and Part B (USEPA 1991b), Exposure Factors Handbook (USEPA 1989b), Standard Default Exposure Factors (USEPA 1991a), Dermal Exposure Assessment: Principles and Applications (USEPA 1992a), and USEPA Supplemental Region IV Risk Assessment Guidance (USEPA 1991d). Environmental data obtained from surface water and sediment samples collected by WCFS in the semiannual sampling events of 1997 were used in this RA. In addition, the RA made use of recent USEPA databases, including the Integrated Risk Information System (IRIS; USEPA 1997a), USEPA Region III Risk-based Concentration Table (USEPA Region III 1997b), and the Health Effects Assessment Summary Tables (HEAST; USEPA 1994).

Based on differences in contaminant sources and exposed populations, the following four stream segments were evaluated in this risk assessment:

- West Soldier Creek, on-Base
- West Soldier Creek, off-Base
- East Soldier Creek, on-Base

- East Soldier Creek, off-Base

The chemicals of concern (COCs) identified include metals, polychlorinated biphenyls (PCBs), chlorinated pesticides, volatile organic compounds (VOCs), and semivolatile organic compounds (SVOCs). An evaluation of potential health risks was performed for a group of exposure scenarios believed to represent potential forms of human activities that could occur at these areas. These exposure scenarios, which are consistent with the RA previously completed for Tinker AFB by WCFS, include the following:

- Construction workers involved in repair or installation of underground pipelines around or under on-Base portions of the creeks; and

- Residents wading or swimming in the off-Base portion of West and East Soldier Creeks.

Swimming was only evaluated for the child scenario for East Soldier Creek; all other scenarios assume wading only. Potential health risks associated with surface water and sediment exposure were evaluated for both on-site construction workers and off-site residents. The results of the risk characterization indicate that for all scenarios, potential cancer risks are below or within the USEPA advisory range of 10^{-6} to 10^{-4} and the USEPA noncarcinogenic health hazard of 1.0. These results indicate that exposure to surface water and sediments in West and East Soldier Creeks is not likely to result in an unacceptable cancer risk or noncarcinogenic hazard for any on-Base or off-Base populations under current or future stream use conditions.

The results of this current RA were compared to those from the two previous RAs prepared by WCFS (1996, 1997b). In general, no dramatic changes between the first two WCFS RAs and the current (third year) WCFS RA were identified as part of a trend analysis. Therefore, no definitive statement can be made regarding trends at East and West Soldier Creeks based on these results. The differences in estimated noncarcinogenic adverse health effects and carcinogenic risks are due to changes in contaminant concentrations and chemicals which were detected in the sediments and surface water. These differences are expected because the stream is a dynamic system affected by such factors as precipitation levels. Effluent outfall

flow and concentrations also impact the dynamics of the stream system. Like heavy precipitation, large volumes of effluent outfall may dilute concentrations in the stream system. Therefore, it is possible for concentrations in the stream to rise despite the closure of outfalls.

To date, none of the RAs indicated any unacceptable adverse health effects or cancer risks associated with exposure to West or East Soldier Creeks for any on-Base or off-Base population under current or future stream use conditions. Consequently, no remedial action is necessary based on risks to human health.

As part of the RA, cleanup goals were developed to identify health-protective levels for each COC. Although remediation is not warranted at the present time (based on risk to human health), the cleanup goals provide a set of "action criteria" should remedial action be required in the future.

1.0
INTRODUCTION

The purpose of an RA, as defined by USEPA, is to "provide a framework for developing the risk information necessary to assist decision-making at remedial sites" [Risk Assessment Guidance for Superfund (RAGS); USEPA 1989a]. As such, this document specifically addresses potential risks associated with exposure to surface water and sediment from portions of East and West Soldier Creek that may have been impacted by contaminant releases from Tinker Air Force Base (AFB).

The organization of this RA follows the basic structure presented in the RAGS. In addition, sections have been included on trend analysis with the two previous WCFS RAs and the development of Remedial Action Objectives (RAOs). The individual sections of this RA consist of the following:

- A discussion of pertinent site background information
- Identification of site-specific chemicals of concern (COCs) for each of the four stream segments under investigation
- An exposure assessment that identifies potentially exposed populations and the exposure parameters used to quantify chemical uptake by those populations
- An assessment of the toxic properties of the COCs
- An estimation of the potential cancer risks and noncarcinogenic health hazards for exposed populations
- Development of RAOs for COCs

- An analysis of uncertainties associated with each of the steps of the RA, and the likely impact of these uncertainties on the results and conclusions of the RA

- Risk trend analysis

- Conclusions and recommendations

1.1 SITE DESCRIPTION

As illustrated on **Figure 1-1**, Tinker Air Force Base (AFB) is located within the corporate limits of Oklahoma City, Oklahoma, approximately seven miles east-southeast of Oklahoma City's inner-core metropolitan area. The Base is bounded by Midwest City on the north, Del City on the northwest, and Oklahoma City on the east, south, and southwest. The boundaries of Tinker AFB are defined by Sooner Road to the west, Douglas Boulevard to the east, Southeast 29th Street to the north, and Southeast 74th Street to the south. Midwest City and Del City are heavily populated and contain both residential and commercial areas. The area under Oklahoma City jurisdiction is lightly developed residential. Tinker AFB lies within an area representing a transition from residential and industrial/commercial land use on the north and west to agricultural land use to the east and south.

The principal surface water drainage ways for Tinker AFB are the Crutcho, Kuhlman, and Soldier Creeks (**Figure 1-2**). The main channel of Soldier Creek is located to the east of Tinker AFB, flowing to the north from its headwaters near Southwest 59th Street to its confluence with Crutcho Creek. Two Soldier Creek tributaries originate on the Base. For the purpose of this RA, the tributary of Soldier Creek east of Building 3001 is named East Soldier Creek and the tributary west of Building 3001 is named West Soldier Creek. East Soldier Creek originates north of Building 3705, flows northward along the east side of Building 3001, past the Industrial Wastewater Treatment Plant (IWTP), and drains into Soldier Creek approximately one mile downstream. West Soldier Creek originates on the west side of Building 3001 and flows northward approximately two miles to its confluence with Soldier Creek.

As identified in the Work Plan (WCFS 1994), the current scope of investigation includes those portions of East and West Soldier Creeks from their points of origin and extending to their intersection with Interstate 40, north of the Base. Study area boundaries coincide with those identified in the Remedial Investigation (RI) report (B&V 1993). Data from the RI indicated that a contaminant concentration gradient exists to a point south (upstream) of the study boundary. The study area boundary was established based on the following criteria:

- Limits of measurable levels of contaminants (as compared to background locations)
- Area of such size that a definitive assessment could be performed
- Allowance for source identification

Because both the contaminants and contaminant sources found in East Soldier Creek differ from those found in West Soldier Creek, these streams are evaluated separately. In addition, the on-Base stream segments of both streams are evaluated separately from their off-Base segments to account for differences in potentially exposed populations. Stream segments and exposure scenarios evaluated in this RA are the same as those evaluated in the two previous RAs (WCFS 1996, 1997b). Based on this approach, the following four stream segments are evaluated separately in this RA:

- West Soldier Creek, on-Base
- West Soldier Creek, off-Base
- East Soldier Creek, on-Base
- East Soldier Creek, off-Base

1.2 SITE OPERATIONS AND REGULATORY HISTORY

Tinker AFB is an active United States Air Force industrial facility responsible for the maintenance of a wide variety of military aircraft. Tinker AFB was activated in March of 1942 under the name of Midwest Air Depot. During World War II, the depot was

responsible for reconditioning, modifying, and modernizing aircraft, vehicles, and equipment. The primary mission has not changed. Tinker AFB is still a major industrial complex for overhauling modifying and repairing military aircraft engines and accessory items.

As part of the overall Air Force Installation Restoration Program (IRP), Tinker AFB began investigating previously used disposal sites in 1981 (USEPA 1988). A Base-wide sampling program was conducted in 1983. Analytical results from the sampling program indicated trichloroethene was present in the groundwater. Remedial investigations were conducted by Tinker AFB through the Tulsa District Corps of Engineers (COE) from 1986 to 1989 to determine the nature and extent of groundwater contamination. These investigations determined that chromium, in addition to trichloroethene, was a COC in groundwater. On July 22, 1987, the Building 3001 site and the Soldier Creek site were added to the National Priorities List (NPL). In 1990 and 1991, B&V conducted a Phase I and Phase II Remedial Investigation/Feasibility Study (RI/FS) to determine the extent of sediment and surface water contamination along East, West, and Main Soldier Creek. As part of the RI, B&V performed a baseline human health RA and concluded that sediment and surface water in Soldier Creek did not pose an unacceptable risk to human health (B&V 1993). WCFS did subsequent RAs and again found that the sediment and surface water in East and West Soldier Creeks posed no unacceptable risk to human health (WCFS 1996, 1997b). Since submission of the RI/FS reports, Tinker AFB has reduced or eliminated releases from several outfalls, including the IWTP outfall, which was closed in April of 1996.

1.3 SITE PHYSICAL SETTING

Tinker AFB is located in an area characterized by gently rolling hills, broad flat plains, and well-entrenched main streams. Ground level ranges from 1,210 feet above sea level on the northwest side of the Base to about 1,320 feet above mean sea level at the southeast corner of the Base (Radian 1985). Historic data from the Tinker AFB weather station indicate that the average annual precipitation at Tinker AFB is approximately 34 inches per year. Rainfall occurs in a distinct, seasonal pattern ranging from a high of 5.8 inches in May to a low of 1.2 inches in January (Parsons 1996).

Soldier Creek and its tributaries receive surface runoff from approximately 9,000 acres. Areas on Tinker AFB that contribute surface water runoff or effluent discharge to Soldier Creek and its tributaries include the easternmost runway areas and the Building 3001 complex. The Building 3001 complex consists of an aircraft overhaul and modification complex to support the mission of the Oklahoma City Air Logistics Center.

The IWTP, located in the northeastern portion of the Base, received industrial process discharge waters from the Building 3001 complex and other buildings and operations in the area through a series of underground lines. At the plant, these waters were treated and discharged to East Soldier Creek under a National Pollutant Discharge Elimination System (NPDES) permit. The IWPT is currently used as a pretreatment facility and no longer discharges to East Soldier Creek on a regular basis. However, the IWTP is still permitted for use in case of emergency.

A sanitary wastewater treatment facility also discharged to East Soldier Creek under the same permit as the IWPT. Sanitary waste currently discharges directly to the Oklahoma City POTW.

A storm sewer investigation was conducted by NUS Corporation (1989) to characterize the sources of the outfalls to Soldier Creek from Tinker AFB. This study identified the following four categories of waste discharge:

- Process discharge, such as cooling tower blowdown
- Low volume sources, such as oils derived from compressors, vacuum pumps and fume handling systems that enter the storm sewer system
- Cross-contamination between waste systems and the storm sewers due to improper connections or broken lines
- Inappropriate disposal of wastes, such as solvents and lubricating oils, into floor drains catch basins, etc. This category of waste discharge is believed to represent the primary source of contamination to Soldier Creek

Discharges from the various Tinker AFB outfalls represent semicontinuous sources to both East and West Soldier Creeks. Studies by Parsons indicate that the relative contribution of the outfalls bear little, if any, correlation to the annual precipitation cycle (Parsons 1996). Thus, it is likely the Tinker AFB outfalls will have year-round influence on surface water quality, while site runoff is more likely to influence surface water in a seasonal fashion.

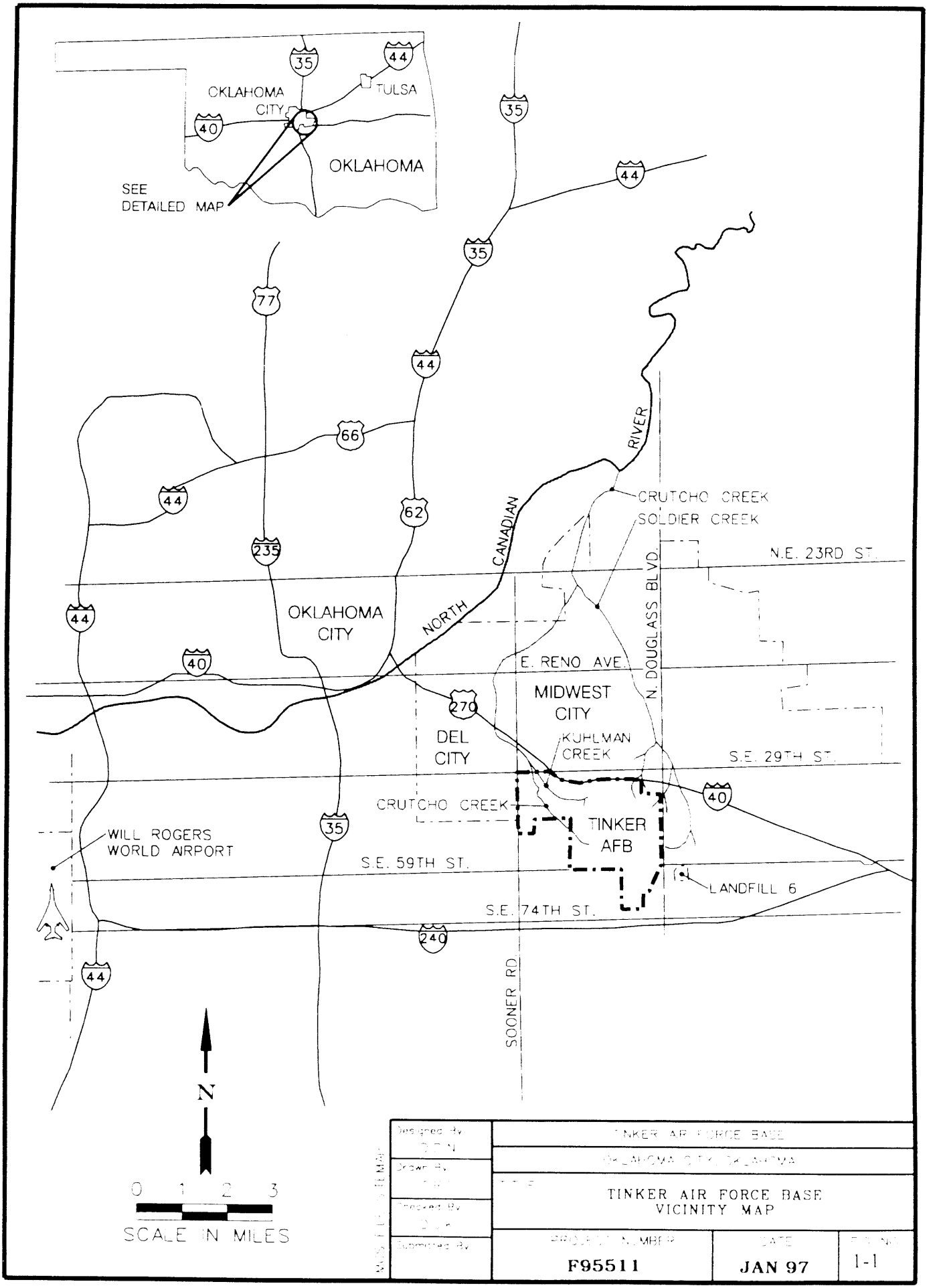
1.4 OBJECTIVES OF THE HUMAN HEALTH RISK ASSESSMENT

Two separate evaluations of the potential risks associated with East and West Soldier Creeks surface water and sediments were previously performed by WCFS (1996, 1997b). The purpose of this RA was to provide information on potential current and future risks based on current contaminant levels, and then compare the results with those of the two previous annual RAs to determine if the previous conclusions are still valid. This RA used the same exposure values and assumptions as previously used so that a direct comparison of results could be made. Finally, this RA developed cleanup goals for stream sediments that are protective of human populations.

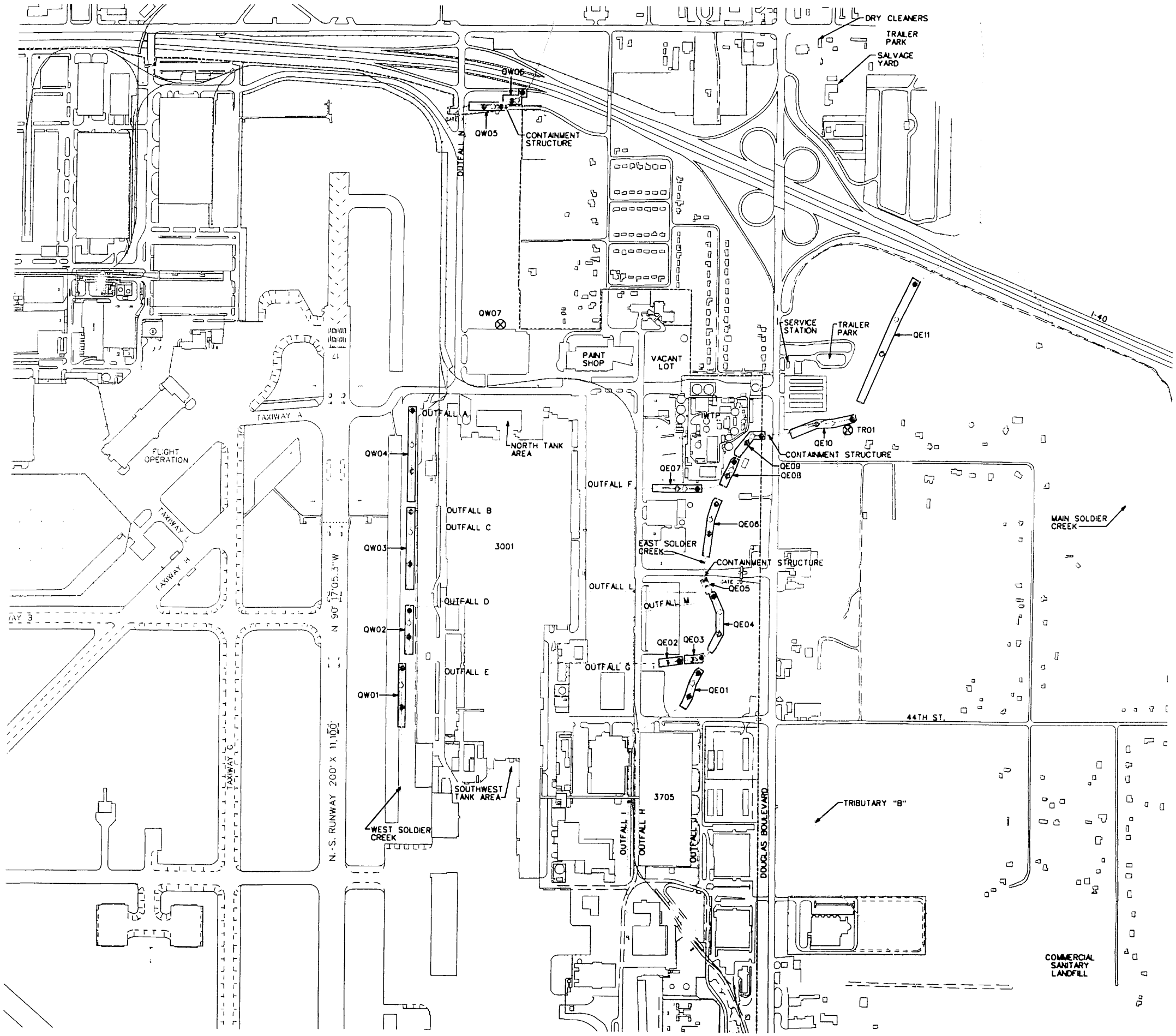
As mentioned previously, development of quantitative risk estimates for potentially exposed populations is based on guidance provided in the RAGS. In addition, a variety of factors are used to characterize and quantify potential health risks, including:

- Chemical fate and transport characteristics
- Basic toxicology information
- Site-specific information relative to potentially exposed populations, exposure routes, exposure point concentrations, and general site conditions

USEPA guidance documents used to conduct the RA include RAGS, the Exposure Factors Handbook (1989b), Standard Default Exposure Factors (1991a), Integrated Risk Information System on-line database (IRIS 1997a), Dermal Exposure Assessment: Principles and Applications (1992a), and Risk Assessment Guidance for Superfund Part B, Development of Risk-based Preliminary Remediation Goals (1991b).



Designed By: D.E.N.	TINKER AIR FORCE BASE	
Drawn By:	OKLAHOMA CITY, OKLAHOMA	
Checked By:	TITLE: TINKER AIR FORCE BASE VICINITY MAP	
Submitted By:	PROJECT NUMBER: F95511	DATE: JAN 97
		FIG. NO. 1-1



LEGEND:

- SOLDIER CREEK AND TRIBUTARIES
- UNDERGROUND PORTION OF CREEK
- BOUNDARY OF TINKER AIR FORCE BASE
- ⊗ SAMPLING LOCATION ON TRIBUTARY B AND QW07
- 1ST QUARTER SAMPLE LOCATION
- 2ND QUARTER SAMPLE LOCATION
- 3RD QUARTER SAMPLE LOCATION
- 4TH QUARTER SAMPLE LOCATION

N

800 0 800 1600

SCALE FEET

Designed By: D.D.N.	TINKER AIR FORCE BASE		
Drawn By: J.W.B.	OKLAHOMA CITY, OKLAHOMA		
Checked By: D.J.K	TITLE: SOLDIER CREEK QUARTERLY MONITORING SAMPLING LOCATIONS		
Submitted By:	PROJECT NUMBER F96515	DATE JAN 1997	FIG. NO. 1-2

MCS FILE: SOLDQ-01-RF-CTABB1

2.0
CHEMICALS OF CONCERN

The purpose of the RA was to evaluate the potential human health risks associated with the site under the no-action alternative (i.e., in the absence of remedial and corrective action). The first step in this evaluation was the selection process used to identify a group of chemicals of concern (COCs). This group of chemicals, although a subset of all chemicals detected on-site, represents those chemicals posing the greatest potential health risks at the site. Thus, the quantification of potential health risks posed by the site can be focused on the COCs without significantly underestimating the total risk. The basic approach used to develop COCs in this report was the same as that used in the RAs previously performed by WCFS (1996, 1997b). Separate lists of COCs have been generated for sediments and surface water for each of the stream segments being investigated, using USEPA selection criteria. The following sections present the COC selection process.

2.1 CHEMICALS EVALUATED AS POTENTIAL COCs

The identification of COCs was based on an evaluation of chemical data from surface water and sediment samples collected by WCFS in the semiannual sampling events of 1997. **Table 2-1** lists the sampling locations associated with each investigation area. A total of four classes of chemicals were evaluated:

- Volatile organic compounds (46 analytes)
- Semivolatile organic compounds (91 analytes)
- PCBs/pesticides (27 analytes)
- Metals (24 analytes)

The numbers in parentheses denote the total number of analytes within each class of chemicals for which analyses were performed. (The number of analytes for surface water varied slightly from those listed above for sediments.)

2.2 CHEMICALS EXCLUDED FROM THE RISK ASSESSMENT

Although the analytical results identified a number of chemicals present in sediment and surface water samples from East and West Soldier Creek, not all of these chemicals are likely to pose risks to human health. Therefore, it is appropriate to systematically exclude selected chemicals from the RA so that the quantitative risk characterization can effectively focus on only those chemicals posing the greatest potential health risks. The RAGS (USEPA 1989a) describes several procedures to reduce the number of chemicals to be considered. Chemicals can be systematically excluded for any of the following reasons:

- The compound was not detected in any sample.
- The compound was found at a low frequency and concentration.
- The compound has a low inherent toxicity or is an essential nutrient.
- The compound was found at background levels.
- The compound was identified as a laboratory contaminant (not applicable to this RA).

The rationale for excluding chemicals meeting any of these criteria is that their contribution to the incremental health risks posed by the site is negligible.

The following sections present the COC selection process and final lists of COCs for surface water and sediments from East and West Soldier Creek.

2.3 COC SELECTION PROCESS

2.3.1 Chemicals Not Detected

Chemicals not detected in a specific stream segment and medium (surface water or sediment) were excluded from the medium-specific COC list for that stream segment. The following tables list chemicals excluded from the COC list because they were not detected:

- **Table 2-2** lists a total of 161 chemicals for which analyses were performed, but were not detected in the surface water in the on-Base portion of West Soldier Creek. These chemicals were excluded from the surface water COC list for this stream segment.

- **Table 2-3** lists a total of 161 chemicals for which analyses were performed, but were not detected in the surface water in the off-Base portion of West Soldier Creek. These chemicals were excluded from the surface water COC list for this stream segment.

- **Table 2-4** lists a total of 157 chemicals for which analyses were performed, but were not detected in the surface water in the on-Base portion of East Soldier Creek. These chemicals were excluded from the surface water COC list for this stream segment.

- **Table 2-5** lists a total of 163 chemicals for which analyses were performed, but were not detected in the surface water in the off-Base portion of East Soldier Creek. These chemicals were excluded from the surface water COC list for this stream segment.

- **Table 2-6** lists a total of 126 chemicals for which analyses were performed, but were not detected in the sediments in the on-Base portion of West Soldier Creek. These chemicals were excluded from the sediment COC list for this stream segment.

- **Table 2-7** lists a total of 140 chemicals for which analyses were performed, but were not detected in the sediments in the off-Base portion of West Soldier Creek. These chemicals were excluded from the sediment COC list for this stream segment.

- **Table 2-8** lists a total of 109 chemicals for which analyses were performed, but were not detected in the sediments in the on-Base portion of East Soldier

Creek. As a result, these chemicals were excluded from the sediment COC list for this stream segment.

- **Table 2-9** lists a total of 145 chemicals for which analyses were performed, but were not detected in the sediments in the off-Base portion of East Soldier Creek. As a result, these chemicals were excluded from the sediment COC list for this stream segment.

2.3.2 Chemicals Detected at Low Frequency

Chemicals detected with low frequency and low concentration do not indicate a clear pattern of contamination. Moreover, the potential health risks that may be associated with low detection-frequency compounds are expected to be much lower compared with more prevalent chemicals based on the potential for more frequent human exposure. In accordance with the RAGS (USEPA 1989a), a frequency of 5 percent was used as the assessment criterion (i.e., chemicals were excluded as potential COCs if they were present $\leq$ 5 percent of all samples). All chemicals detected in 5 percent (or less) of the samples were then compared to USEPA Region III Risk-based Concentrations (RBCs) (USEPA 1997b) to ensure that chemicals present as "hot spots" were not being excluded. If the maximum detected concentration exceeded the RBC for industrial soils, the chemical was retained as a COC. If the maximum concentration was below the EPA Region III RBC, the chemical was excluded as a potential COC.

Because of the limited number of surface water samples, no chemicals could be excluded from the COC list on the basis of low frequency of detection. Additionally, the off-Base segments for both the West and East Soldier Creek sediments also had a limited number of samples; thus, no chemicals were excluded from these COC lists based on low frequency of detection criterion. The following tables list chemicals that were excluded as potential COCs based on the low frequency and low concentration criteria.

- **Table 2-10** lists a total of 8 chemicals detected at low frequency and at low concentrations in sediment samples collected from the on-Base portion of

West Soldier Creek. These chemicals were excluded from the surface water COC list for that stream segment.

- **Table 2-11** lists a total of 3 chemicals detected at low frequency and at low concentrations in sediments collected from the on-Base portion of East Soldier Creek. These chemicals were excluded from the sediment COC list for that stream segment.

2.3.3 Essential Nutrients

Chemicals that are essential nutrients may be excluded from consideration when they are present at relatively low levels (i.e., levels that are likely to produce beneficial rather than toxic effects) (USEPA 1989a). Comparisons were made between the estimated intake of essential nutrients found in surface water and sediment and the recommended daily allowances (RDAs) established by the National Research Council (NRC) (1989). Daily intake of nutrients from East and West Soldier Creek was estimated from maximum detected concentrations, assuming that an individual ingests 0.5 L/day of surface water (an upper-bound water ingestion value assuming 10 hours swimming), or 100 mg/kg of sediments (the upper-bound daily soil ingestion rate for adults). Essential nutrient evaluation was performed for calcium, chromium, copper, fluoride, iodine, iron, magnesium, manganese, molybdenum, phosphorus, potassium, selenium, and zinc.

In addition to chemicals excluded based on RDAs, sodium was also excluded based on comparison with normal dietary intake. While sodium is an essential nutrient, there is not an established RDA for this element. The normal dietary intake of sodium in the U.S. is greater than 10,000 mg/day (Nelson 1992), while dietary levels less than 1,000 mg/day are considered "sodium-restricted."

The following tables list chemicals that are essential nutrients and that were excluded from the COC lists because they are present at concentrations that are likely to be beneficial rather than detrimental:

- A total of 10 nutrients (**Table 2-12**) were excluded from the surface water COC list for the on-Base portion of West Soldier Creek.

- A total of 10 nutrients (**Table 2-13**) were excluded from the surface water COC list for the off-Base portion of West Soldier Creek.

- A total of 11 nutrients (**Table 2-14**) were excluded from the surface water COC list for the on-Base portion of East Soldier Creek.

- A total of 10 nutrients (**Table 2-15**) were excluded from the surface water COC list for the off-Base portion of East Soldier Creek.

- A total of 10 nutrients (**Table 2-16**) were excluded from the sediment COC list for the on-Base portion of West Soldier Creek.

- A total of 10 nutrients (**Table 2-17**) were excluded from the sediment COC list for the off-Base portion of West Soldier Creek.

- A total of 10 nutrients (**Table 2-18**) were excluded from the sediment COC list for the on-Base portion of East Soldier Creek.

- A total of 10 nutrients (**Table 2-19**) were excluded from the sediment COC list for the off-Base portion of East Soldier Creek.

2.3.4 Chemicals Present at Background Concentrations

As noted in the RAGS (USEPA 1989a), a comparison of sample concentrations to naturally occurring background concentrations can be used to identify nonsite-related chemicals. This approach was taken for evaluating inorganic chemicals only. The maximum concentrations for samples collected from an upstream and off-Base portion of Crutcho Creek (PES 1996) were considered as the background concentrations. Chemicals found to be present at concentrations within 2 times background concentrations were assumed to be present at background levels (as defined in USEPA Region IV, USEPA 1991d), and were subsequently

not included on the list of potential chemicals of concern. Based on this analysis, the following chemicals were excluded as potential COCs:

- A total of 4 chemicals (**Table 2-20**) were excluded from the surface water COC list on-Base portion of West Soldier Creek because they were detected at background levels.

- A total of 4 chemicals (**Table 2-21**) were excluded from the surface water COC list for the off-Base portion of West Soldier Creek because they were detected at background levels.

- A total of 4 chemicals (**Table 2-22**) were excluded from the surface water COC list the on-Base portion of East Soldier Creek because they were detected at background levels.

- A total of 4 chemicals (**Table 2-23**) were excluded from the surface water COC list for the off-Base portion of East Soldier Creek because they were detected at background levels.

- A total of 4 chemicals (**Table 2-24**) were excluded from the sediment COC list for the on-Base portion of West Soldier Creek because they were detected at background levels.

- A total of 4 chemicals (**Table 2-25**) were excluded from the sediment COC list for the off-Base portion of West Soldier Creek because they were detected at background levels.

- A total of 3 chemicals (**Table 2-26**) were excluded from the sediment COC list for the on-Base portion of East Soldier Creek because they were detected at background levels.

- A total of 6 chemicals (**Table 2-27**) were excluded from the sediment COC list for the off-Base portion of East Soldier Creek because they were detected at background levels.

2.4 CHEMICALS OF CONCERN

A group of COCs was identified based on the criteria described in the previous sections for each environmental medium (surface water and sediments) in each stream segment. It is important to note that many of the identified COCs are present at very low concentrations and well below human health-based criteria such as maximum contaminant levels (MCLs). These chemicals have been retained for future evaluation as a conservative measure. These selected chemicals are further evaluated in the quantitative RA to determine whether they may contribute risks to the human receptors discussed in **Section 3.0**. The COCs, maximum and minimum detected concentrations, and frequency of detection are listed in the following tables:

- **Table 2-28** presents the COCs for surface water in the on-Base portion of West Soldier Creek.

- **Table 2-29** presents the COCs for surface water in the off-Base portion of West Soldier Creek.

- **Table 2-30** presents the COCs for surface water in the on-Base portion of East Soldier Creek.

- **Table 2-31** presents the COCs for surface water in the off-Base portion of East Soldier Creek.

- **Table 2-32** presents the COCs for sediments in the on-Base portion of West Soldier Creek.

- **Table 2-33** presents the COCs for sediments in the off-Base portion of West Soldier Creek.

- **Table 2-34** presents the COCs for sediments in the on-Base portion of East Soldier Creek.

- **Table 2-35** presents the COCs for sediments in the off-Base portion of East Soldier Creek.

TABLE 2-1

SAMPLING LOCATIONS IN EACH STREAM SEGMENT

AREA	SAMPLE LOCATION
On-Base West Soldier Creek (Area 1)	QW01 QW02 QW03 QW04 QW07
Off-Base West Soldier Creek (Area 2)	QW05 QW06
On-Base East Soldier Creek (Area 3)	QE01 QE02 QE03 QE04 QE05 QE06 QE07 QE08 QE09
Off-Base East Soldier Creek (Area 4)	QE10 QE11

TABLE 2-2

CHEMICALS NOT DETECTED IN ON-BASE WEST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
Metals	Beryllium	3
	Mercury	3
	Silver	3
	Thallium	3
PCBs/Pesticides	4,4'-DDD	3
	4,4'-DDE	3
	4,4'-DDT	3
	Aldrin	3
	Aroclor 1016	3
	Aroclor 1221	3
	Aroclor 1232	3
	Aroclor 1242	3
	Aroclor 1248	3
	Aroclor 1254	3
	Aroclor 1260	3
	Dieldrin	3
	Endosulfan I	3
	Endosulfan II	3
	Endosulfan sulfate	3
	Endrin	3
	Heptachlor	3
	Heptachlor epoxide	3
	Methoxychlor	3
	Toxaphene	3
	alpha-BHC	3
	alpha-Chlordane	3
	beta-BHC	3
	delta-BHC	3
	gamma-BHC (Lindane)	3
	gamma-Chlordane	3
Semivolatile Organics	1,2,4,5-Tetrachloro-benzene	3
	1,2,4-Trichlorobenzene	3
	1,2-Dichlorobenzene	3
	1,3-Dichlorobenzene	3
	1,4-Dichlorobenzene	3
	1-Chloronaphthalene	3
	1-Naphthylamine	3
	2,2'-oxybis(1-Chloropropane)	3
	2,3,4,6-Tetrachlorophenol	3
	2,4,5-Trichlorophenol	3
	2,4,6-Trichlorophenol	3
	2,4-Dichlorophenol	3
	2,4-Dimethylphenol	3
	2,4-Dinitrophenol	3
	2,4-Dinitrotoluene	3

TABLE 2-2

CHEMICALS NOT DETECTED IN ON-BASE WEST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
Semivolatile Organics	2,6-Dichlorophenol	3
(Continued)	2,6-Dinitrotoluene	3
	2-Chloronaphthalene	3
	2-Chlorophenol	3
	2-Methylnaphthalene	3
	2-Methylphenol	3
	2-Naphthylamine	3
	2-Nitrophenol	3
	2-Picoline	3
	3,3'-Dichlorobenzidine	3
	3-Methylcholanthrene	3
	3-Nitroaniline	3
	3/4-Methylphenol	3
	4,6-Dinitro-2-methylphenol	3
	4-Aminobiphenyl	3
	4-Bromophenyl phenyl ether	3
	4-Chloro-3-methylphenol	3
	4-Chloroaniline	3
	4-Chlorophenyl phenyl ether	3
	4-Nitroaniline	3
	4-Nitrophenol	3
	7,12-Dimethylbenz(a)-anthracene	3
	Acenaphthene	3
	Acenaphthylene	3
	Acetophenone	3
	Aniline	3
	Anthracene	3
	Azobenzene	3
	Benzidine	3
	Benzo(a)anthracene	3
	Benzo(a)pyrene	3
	Benzo(b)fluoranthene	3
	Benzo(g,h,i)perylene	3
	Benzo(k)fluoranthene	3
	Benzoic acid	3
	Benzyl alcohol	3
	Butyl benzyl phthalate	3
	Chrysene	3
	Di-n-butyl phthalate	3
	Di-n-octyl phthalate	3
	Dibenz(a,h)anthracene	3
	Dibenzofuran	3
	Diethyl phthalate	3
	Dimethyl phthalate	3
	Diphenylamine	3

TABLE 2-2

CHEMICALS NOT DETECTED IN ON-BASE WEST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
Semivolatile Organics	Ethyl methanesulfonate	3
(Continued)	Fluoranthene	3
	Fluorene	3
	Hexachlorobenzene	3
	Hexachlorobutadiene	3
	Hexachlorocyclopentadiene	3
	Hexachloroethane	3
	Indeno(1,2,3-cd)pyrene	3
	Isophorone	3
	Methyl methanesulfonate	3
	N-Nitroso-di-n-butylamine	3
	N-Nitroso-di-n-propylamine	3
	N-Nitrosodiphenylamine	3
	N-Nitrosopiperidine	3
	Naphthalene	3
	Nitrobenzene	3
	Pentachlorobenzene	3
	Pentachloronitrobenzene	3
	Pentachlorophenol	3
	Phenacetin	3
	Phenanthrene	3
	Phenol	3
	Pronamide	3
	Pyrene	3
	a,a-Dimethylphenethyl-amine	3
	bis(2-Chloroethoxy)methane	3
	bis(2-Chloroethyl) ether	3
	p-Dimethylaminoazobenzene	3
Volatile Organics	1,1,1,2-Tetrachloroethane	3
	1,1,1-Trichloroethane	3
	1,1,2,2-Tetrachloroethane	3
	1,1,2-Trichloroethane	3
	1,1-Dichloroethane	3
	1,1-Dichloroethene	3
	1,2,3-Trichloropropane	3
	1,2-Dichloroethane	3
	1,2-Dichloropropane	3
	2-Butanone (MEK)	3
	2-Chloroethyl vinyl ether	3
	2-Hexanone	3
	4-Methyl-2-pentanone (MIBK)	3
	Acrolein	3
	Acrylonitrile	3
	Benzene	3
	Bromodichloromethane	3

TABLE 2-2

CHEMICALS NOT DETECTED IN ON-BASE WEST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
Volatile Organics	Bromoform	3
(Continued)	Bromomethane	3
	Carbon disulfide	3
	Carbon tetrachloride	3
	Chlorobenzene	3
	Chloroethane	3
	Chloroform	3
	Dibromochloromethane	3
	Dibromomethane	3
	Dichlorodifluoromethane	3
	Ethanol	3
	Ethyl methacrylate	3
	Ethylbenzene	3
	Iodomethane	3
	Methylene chloride	3
	Tetrachloroethene	3
	Toluene	3
	Trichloroethene	3
	Trichlorofluoromethane	3
	Vinyl acetate	3
	Vinyl chloride	3
	Xylenes (total)	3
	cis-1,3-Dichloropropene	3
	trans-1,2-Dichloroethene	3
	trans-1,3-Dichloropropene	3
	trans-1,4-Dichloro-2-butene	3

TABLE 2-3

CHEMICALS NOT DETECTED IN OFF-BASE WEST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
Metals	Arsenic	4
	Beryllium	4
	Mercury	4
	Silver	4
	Thallium	4
Pesticides/PCBs	4,4'-DDD	4
	4,4'-DDE	4
	4,4'-DDT	4
	Aldrin	4
	Aroclor 1016	4
	Aroclor 1221	4
	Aroclor 1232	4
	Aroclor 1242	4
	Aroclor 1248	4
	Aroclor 1254	4
	Aroclor 1260	4
	Dieldrin	4
	Endosulfan I	4
	Endosulfan II	4
	Endosulfan sulfate	4
	Endrin	4
	Heptachlor	4
	Heptachlor epoxide	4
	Methoxychlor	4
	Toxaphene	4
	alpha-BHC	4
	alpha-Chlordane	4
	beta-BHC	4
	delta-BHC	4
	gamma-BHC (Lindane)	4
	gamma-Chlordane	4
Semivolatile Organics	1,2,4,5-Tetrachloro-benzene	4
	1,2,4-Trichlorobenzene	4
	1,2-Dichlorobenzene	4
	1,3-Dichlorobenzene	4
	1,4-Dichlorobenzene	4
	1-Chloronaphthalene	4
	1-Naphthylamine	4
	2,2'-oxybis(1-Chloropropane)	4
	2,3,4,6-Tetrachlorophenol	4
	2,4,5-Trichlorophenol	4
	2,4,6-Trichlorophenol	4
	2,4-Dichlorophenol	4
	2,4-Dimethylphenol	4
	2,4-Dinitrophenol	4

TABLE 2-3

CHEMICALS NOT DETECTED IN OFF-BASE WEST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
Semivolatile Organics	2,4-Dinitrotoluene	4
(Continued)	2,6-Dichlorophenol	4
	2,6-Dinitrotoluene	4
	2-Chloronaphthalene	4
	2-Chlorophenol	4
	2-Methylnaphthalene	4
	2-Methylphenol	4
	2-Naphthylamine	4
	2-Nitrophenol	4
	2-Picoline	4
	3,3'-Dichlorobenzidine	4
	3-Methylcholanthrene	4
	3-Nitroaniline	4
	3/4-Methylphenol	4
	4,6-Dinitro-2-methylphenol	4
	4-Aminobiphenyl	4
	4-Bromophenyl phenyl ether	4
	4-Chloro-3-methylphenol	4
	4-Chloroaniline	4
	4-Chlorophenyl phenyl ether	4
	4-Nitroaniline	4
	4-Nitrophenol	4
	7,12-Dimethylbenz(a)-anthracene	4
	Acenaphthene	4
	Acenaphthylene	4
	Acetophenone	4
	Aniline	4
	Anthracene	4
	Azobenzene	4
	Benzidine	4
	Benzo(a)anthracene	4
	Benzo(a)pyrene	4
	Benzo(b)fluoranthene	4
	Benzo(g,h,i)perylene	4
	Benzo(k)fluoranthene	4
	Benzoic acid	4
	Benzyl alcohol	4
	Butyl benzyl phthalate	4
	Chrysene	4
	Di-n-butyl phthalate	4
	Di-n-octyl phthalate	4
	Dibenz(a,h)anthracene	4
	Dibenzofuran	4
	Diethyl phthalate	4
	Dimethyl phthalate	4

TABLE 2-3

CHEMICALS NOT DETECTED IN OFF-BASE WEST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
Semivolatile Organics	Diphenylamine	4
(Continued)	Ethyl methanesulfonate	4
	Fluoranthene	4
	Fluorene	4
	Hexachlorobenzene	4
	Hexachlorobutadiene	4
	Hexachlorocyclopentadiene	4
	Hexachloroethane	4
	Indeno(1,2,3-cd)pyrene	4
	Isophorone	4
	Methyl methanesulfonate	4
	N-Nitroso-di-n-butylamine	4
	N-Nitroso-di-n-propylamine	4
	N-Nitrosodiphenylamine	4
	N-Nitrosopiperidine	4
	Naphthalene	4
	Nitrobenzene	4
	Pentachlorobenzene	4
	Pentachloronitrobenzene	4
	Pentachlorophenol	4
	Phenacetin	4
	Phenanthrene	4
	Phenol	4
	Pronamide	4
	Pyrene	4
	a,a-Dimethylphenethyl-amine	4
	bis(2-Chloroethoxy)methane	4
	bis(2-Chloroethyl) ether	4
	bis(2-Ethylhexyl)phthalate	4
	p-Dimethylaminoazobenzene	4
Volatile Organics	1,1,1,2-Tetrachloroethane	4
	1,1,1-Trichloroethane	4
	1,1,2,2-Tetrachloroethane	4
	1,1,2-Trichloroethane	4
	1,1-Dichloroethane	4
	1,1-Dichloroethene	4
	1,2,3-Trichloropropane	4
	1,2-Dichloroethane	4
	1,2-Dichloropropane	4
	2-Butanone (MEK)	4
	2-Chloroethyl vinyl ether	4
	2-Hexanone	4
	4-Methyl-2-pentanone (MIBK)	4
	Acrolein	1
	Acrylonitrile	1

TABLE 2-3

CHEMICALS NOT DETECTED IN OFF-BASE WEST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
Volatile Organics	Benzene	4
(Continued)	Bromodichloromethane	4
	Bromoform	4
	Carbon disulfide	4
	Carbon tetrachloride	4
	Chlorobenzene	4
	Chloroethane	4
	Chloroform	4
	Dibromochloromethane	4
	Dibromomethane	4
	Dichlorodifluoromethane	4
	Ethanol	4
	Ethyl methacrylate	4
	Ethylbenzene	4
	Styrene	4
	Tetrachloroethene	4
	Toluene	4
	Trichloroethene	4
	Trichlorofluoromethane	4
	Vinyl acetate	4
	Vinyl chloride	4
	Xylenes (total)	4
	cis-1,3-Dichloropropene	4
	trans-1,2-Dichloroethene	4
	trans-1,3-Dichloropropene	4
	trans-1,4-Dichloro-2-butene	4

TABLE 2-4

CHEMICALS NOT DETECTED IN ON-BASE EAST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
Metals	Beryllium	18
	Mercury	18
	Thallium	18
Pesticides/PCBs	4,4'-DDD	18
	4,4'-DDE	18
	4,4'-DDT	18
	Aldrin	18
	Aroclor 1016	18
	Aroclor 1221	18
	Aroclor 1232	18
	Aroclor 1242	18
	Aroclor 1248	18
	Aroclor 1260	18
	Dieldrin	18
	Endosulfan I	18
	Endosulfan II	18
	Endosulfan sulfate	18
	Endrin	18
	Heptachlor	18
	Heptachlor epoxide	18
	Methoxychlor	18
	Toxaphene	18
	alpha-BHC	18
	alpha-Chlordane	18
	beta-BHC	18
	delta-BHC	18
	gamma-BHC (Lindane)	18
	gamma-Chlordane	18
Semivolatile Organics	1,2,4,5-Tetrachloro-benzene	18
	1,2,4-Trichlorobenzene	18
	1,2-Dichlorobenzene	18
	1,3-Dichlorobenzene	18
	1,4-Dichlorobenzene	18
	1-Chloronaphthalene	18
	1-Naphthylamine	18
	2,2'-oxybis(1-Chloropropane)	18
	2,3,4,6-Tetrachlorophenol	18
	2,4,5-Trichlorophenol	18
	2,4,6-Trichlorophenol	18
	2,4-Dichlorophenol	18
	2,4-Dimethylphenol	18
	2,4-Dinitrophenol	18
	2,4-Dinitrotoluene	18
	2,6-Dichlorophenol	18
	2,6-Dinitrotoluene	18
	2-Chloronaphthalene	18

TABLE 2-4

CHEMICALS NOT DETECTED IN ON-BASE EAST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
Semivolatile Organics	2-Chlorophenol	18
(Continued)	2-Methylnaphthalene	18
	2-Methylphenol	18
	2-Naphthylamine	18
	2-Nitrophenol	18
	2-Picoline	18
	3,3'-Dichlorobenzidine	18
	3-Methylcholanthrene	18
	3-Nitroaniline	18
	3,4-Methylphenol	18
	4,6-Dinitro-2-methylphenol	18
	4-Aminobiphenyl	18
	4-Bromophenyl phenyl ether	18
	4-Chloro-3-methylphenol	18
	4-Chloroaniline	18
	4-Chlorophenyl phenyl ether	18
	4-Nitroaniline	18
	4-Nitrophenol	18
	7,12-Dimethylbenz(a)-anthracene	18
	Acenaphthene	18
	Acenaphthylene	18
	Acetophenone	18
	Aniline	18
	Anthracene	18
	Azobenzene	18
	Benzidine	18
	Benzo(a)anthracene	18
	Benzo(a)pyrene	18
	Benzo(b)fluoranthene	18
	Benzo(g,h,i)perylene	18
	Benzo(k)fluoranthene	18
	Benzoic acid	18
	Benzyl alcohol	18
	Butyl benzyl phthalate	18
	Chrysene	18
	Di-n-butyl phthalate	18
	Di-n-octyl phthalate	18
	Dibenz(a,h)anthracene	18
	Dibenzofuran	18
	Diethyl phthalate	18
	Dimethyl phthalate	18
	Diphenylamine	18
	Ethyl methanesulfonate	18
	Fluoranthene	18
	Fluorene	18
	Hexachlorobenzene	18

TABLE 2-4

CHEMICALS NOT DETECTED IN ON-BASE EAST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
Semivolatile Organics	Hexachlorobutadiene	18
(Continued)	Hexachlorocyclopentadiene	18
	Hexachloroethane	18
	Indeno(1,2,3-cd)pyrene	18
	Isophorone	18
	Methyl methanesulfonate	18
	N-Nitroso-di-n-butylamine	18
	N-Nitroso-di-n-propylamine	18
	N-Nitrosodiphenylamine	18
	N-Nitrosopiperidine	18
	Naphthalene	18
	Nitrobenzene	18
	Pentachlorobenzene	18
	Pentachloronitrobenzene	18
	Pentachlorophenol	18
	Phenacetin	18
	Phenanthrene	18
	Phenol	18
	Pronamide	18
	Pyrene	18
	a,a-Dimethylphenethyl-amine	18
	bis(2-Chloroethoxy)methane	18
	bis(2-Chloroethyl) ether	18
	p-Dimethylaminoazobenzene	18
Volatile Organics	1,1,1,2-Tetrachloroethane	18
	1,1,1-Trichloroethane	18
	1,1,2,2-Tetrachloroethane	18
	1,1,2-Trichloroethane	18
	1,1-Dichloroethane	18
	1,1-Dichloroethene	18
	1,2,3-Trichloropropane	18
	1,2-Dichloroethane	18
	1,2-Dichloropropane	18
	2-Butanone (MEK)	18
	2-Chloroethyl vinyl ether	18
	2-Hexanone	18
	4-Methyl-2-pentanone (MIBK)	18
	Acrolein	18
	Acrylonitrile	18
	Benzene	18
	Bromodichloromethane	18
	Bromomethane	18
	Carbon disulfide	18
	Carbon tetrachloride	18
	Chlorobenzene	18
	Chloroethane	18

TABLE 2-4

CHEMICALS NOT DETECTED IN ON-BASE EAST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
Volatile Organics	Chloroform	18
(Continued)	Chloromethane	18
	Dibromomethane	18
	Dichlorodifluoromethane	18
	Ethyl methacrylate	18
	Ethylbenzene	18
	Iodomethane	18
	Styrene	18
	Tetrachloroethene	18
	Toluene	18
	Trichloroethene	18
	Trichlorofluoromethane	18
	Vinyl acetate	18
	Vinyl chloride	18
	Xylenes (total)	18
	cis-1,3-Dichloropropene	18
	trans-1,2-Dichloroethene	18
	trans-1,3-Dichloropropene	18
	trans-1,4-Dichloro-2-butene	18

TABLE 2-5

CHEMICALS NOT DETECTED IN OFF-BASE EAST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
Metals	Beryllium	3
	Mercury	4
	Silver	3
	Thallium	3
Pesticides/PCBs	4,4'-DDD	4
	4,4'-DDE	4
	4,4'-DDT	4
	Aldrin	4
	Aroclor 1016	4
	Aroclor 1221	4
	Aroclor 1232	4
	Aroclor 1242	4
	Aroclor 1248	4
	Aroclor 1254	4
	Aroclor 1260	4
	Dieldrin	4
	Endosulfan I	4
	Endosulfan II	4
	Endosulfan sulfate	4
	Endrin	4
	Heptachlor	4
	Heptachlor epoxide	4
	Methoxychlor	4
	Toxaphene	4
	alpha-BHC	4
	alpha-Chlordane	4
	beta-BHC	4
	delta-BHC	4
	gamma-BHC (Lindane)	4
	gamma-Chlordane	4
Semivolatile Organics	1,2,4,5-Tetrachloro-benzene	4
	1,2,4-Trichlorobenzene	4
	1,2-Dichlorobenzene	4
	1,3-Dichlorobenzene	4
	1,4-Dichlorobenzene	4
	1-Chloronaphthalene	4
	1-Naphthylamine	4
	2,2'-oxybis(1-Chloropropane)	4
	2,3,4,6-Tetrachlorophenol	4
	2,4,5-Trichlorophenol	4
	2,4,6-Trichlorophenol	4
	2,4-Dichlorophenol	4
	2,4-Dimethylphenol	4
	2,4-Dinitrophenol	4

TABLE 2-5

CHEMICALS NOT DETECTED IN OFF-BASE EAST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
Semivolatile Organics	2,4-Dinitrotoluene	4
(Continued)	2,6-Dichlorophenol	4
	2,6-Dinitrotoluene	4
	2-Chloronaphthalene	4
	2-Chlorophenol	4
	2-Methylnaphthalene	4
	2-Methylphenol	4
	2-Naphthylamine	4
	2-Nitrophenol	4
	2-Picoline	4
	3,3'-Dichlorobenzidine	4
	3-Methylcholanthrene	4
	3-Nitroaniline	4
	3/4-Methylphenol	4
	4,6-Dinitro-2-methylphenol	4
	4-Aminobiphenyl	4
	4-Bromophenyl phenyl ether	4
	4-Chloro-3-methylphenol	4
	4-Chloroaniline	4
	4-Chlorophenyl phenyl ether	4
	4-Nitroaniline	4
	4-Nitrophenol	4
	7,12-Dimethylbenz(a)-anthracene	4
	Acenaphthene	4
	Acenaphthylene	4
	Acetophenone	4
	Aniline	4
	Anthracene	4
	Azobenzene	4
	Benzidine	4
	Benzo(a)anthracene	4
	Benzo(a)pyrene	4
	Benzo(b)fluoranthene	4
	Benzo(g,h,i)perylene	4
	Benzo(k)fluoranthene	4
	Benzoic acid	4
	Benzyl alcohol	4
	Butyl benzyl phthalate	4
	Chrysene	4
	Di-n-butyl phthalate	4
	Di-n-octyl phthalate	4
	Dibenz(a,h)anthracene	4
	Dibenzofuran	4
	Diethyl phthalate	4

TABLE 2-5

CHEMICALS NOT DETECTED IN OFF-BASE EAST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
Semivolatile Organics	Dimethyl phthalate	4
(Continued)	Diphenylamine	4
	Ethyl methanesulfonate	4
	Fluoranthene	4
	Fluorene	4
	Hexachlorobenzene	4
	Hexachlorobutadiene	4
	Hexachlorocyclopentadiene	4
	Hexachloroethane	4
	Indeno(1,2,3-cd)pyrene	4
	Isophorone	4
	Methyl methanesulfonate	4
	N-Nitroso-di-n-butylamine	4
	N-Nitroso-di-n-propylamine	4
	N-Nitrosodiphenylamine	4
	N-Nitrosopiperidine	4
	Naphthalene	4
	Nitrobenzene	4
	Pentachlorobenzene	4
	Pentachloronitrobenzene	4
	Pentachlorophenol	4
	Phenacetin	4
	Phenanthrene	4
	Phenol	4
	Pronamide	4
	Pyrene	4
	a,a-Dimethylphenethyl-amine	4
	bis(2-Chloroethoxy)methane	4
	bis(2-Chloroethyl) ether	4
	p-Dimethylaminoazobenzene	4
Volatile Organics	1,1,1,2-Tetrachloroethane	4
	1,1,1-Trichloroethane	4
	1,1,2,2-Tetrachloroethane	4
	1,1,2-Trichloroethane	4
	1,1-Dichloroethane	4
	1,1-Dichloroethene	4
	1,2,3-Trichloropropane	4
	1,2-Dichloroethane	4
	1,2-Dichloropropane	4
	2-Butanone (MEK)	4
	2-Chloroethyl vinyl ether	4
	2-Hexanone	4
	4-Methyl-2-pentanone (MIBK)	4
	Acrolein	4

TABLE 2-5

CHEMICALS NOT DETECTED IN OFF-BASE EAST SOLDIER CREEK SURFACE WATER

Chemical Group	Chemical	Number of Samples
Volatile Organics	Acrylonitrile	4
(Continued)	Benzene	4
	Bromodichloromethane	4
	Bromoform	4
	Bromomethane	4
	Carbon disulfide	4
	Carbon tetrachloride	4
	Chlorobenzene	4
	Chloroethane	4
	Chloroform	4
	Chloromethane	4
	Dibromochloromethane	4
	Dibromomethane	4
	Dichlorodifluoromethane	4
	Ethanol	2
	Ethyl methacrylate	4
	Ethylbenzene	4
	Iodomethane	4
	Methylene chloride	4
	Styrene	4
	Tetrachloroethene	4
	Toluene	4
	Trichloroethene	4
	Trichlorofluoromethane	4
	Vinyl acetate	4
	Vinyl chloride	4
	Xylenes (total)	4
	cis-1,3-Dichloropropene	4
	trans-1,2-Dichloroethene	4
	trans-1,3-Dichloropropene	4
	trans-1,4-Dichloro-2-butene	4

TABLE 2-6

CHEMICALS NOT DETECTED IN ON-BASE WEST SOLDIER CREEK SEDIMENTS

Chemical Group	Chemical	Number of Samples
Pesticides/PCBS	4,4'-DDD	28
	4,4'-DDT	28
	Aroclor 1016	28
	Aroclor 1221	28
	Aroclor 1232	28
	Aroclor 1242	28
	Aroclor 1248	28
	Aroclor 1260	28
	Dieldrin	28
	Endosulfan I	28
	Endosulfan II	28
	Endosulfan sulfate	28
	Endrin	28
	Heptachlor	28
	Methoxychlor	28
	Toxaphene	28
	alpha-BHC	28
	alpha-Chlordane	28
	beta-BHC	28
	delta-BHC	28
	gamma-BHC (Lindane)	28
	gamma-Chlordane	28
Semivolatile Organics	1,2,4,5-Tetrachloro-benzene	28
	1,2,4-Trichlorobenzene	28
	1,3-Dichlorobenzene	28
	1,4-Dichlorobenzene	28
	1-Chloronaphthalene	28
	1-Naphthylamine	28
	2,2'-oxybis(1-Chloropropane)	28
	2,3,4,6-Tetrachlorophenol	28
	2,4,5-Trichlorophenol	28
	2,4,6-Trichlorophenol	28
	2,4-Dichlorophenol	28
	2,4-Dimethylphenol	28
	2,4-Dinitrophenol	28
	2,4-Dinitrotoluene	28
	2,6-Dichlorophenol	28
	2,6-Dinitrotoluene	28
	2-Chloronaphthalene	28
	2-Chlorophenol	28
	2-Methylphenol	28
	2-Naphthylamine	28
	2-Nitrophenol	28
	2-Picoline	28
	3,3'-Dichlorobenzidine	28
	3-Methylcholanthrene	28

TABLE 2-6

CHEMICALS NOT DETECTED IN ON-BASE WEST SOLDIER CREEK SEDIMENTS

Chemical Group	Chemical	Number of Samples
Semivolatile Organics	3-Nitroaniline	28
(Continued)	3/4-Methylphenol	28
	4,6-Dinitro-2-methylphenol	28
	4-Aminobiphenyl	28
	4-Bromophenyl phenyl ether	28
	4-Chloro-3-methylphenol	28
	4-Chloroaniline	28
	4-Chlorophenyl phenyl ether	28
	4-Nitroaniline	28
	4-Nitrophenol	28
	7,12-Dimethylbenz(a)-anthracene	28
	Acetophenone	28
	Aniline	28
	Azobenzene	28
	Benzoic acid	28
	Benzyl alcohol	28
	Butyl benzyl phthalate	28
	Diethyl phthalate	28
	Dimethyl phthalate	28
	Diphenylamine	28
	Ethyl methanesulfonate	28
	Hexachlorobenzene	28
	Hexachlorobutadiene	28
	Hexachlorocyclopentadiene	28
	Hexachloroethane	28
	Isophorone	28
	Methyl methanesulfonate	28
	N-Nitroso-di-n-butylamine	28
	N-Nitroso-di-n-propylamine	28
	N-Nitrosodiphenylamine	28
	N-Nitrosopiperidine	28
	Nitrobenzene	28
	Pentachlorobenzene	28
	Pentachloronitrobenzene	28
	Pentachlorophenol	28
	Phenacetin	28
	Phenol	28
	Pronamide	28
	a,a-Dimethylphenethyl-amine	28
	bis(2-Chloroethoxy)methane	28
	bis(2-Chloroethyl) ether	28
	p-Dimethylaminoazobenzene	28
Volatile Organics	1,1,1,2-Tetrachloroethane	28
	1,1,1-Trichloroethane	28
	1,1,2,2-Tetrachloroethane	28
	1,1,2-Trichloroethane	28

TABLE 2-6

CHEMICALS NOT DETECTED IN ON-BASE WEST SOLDIER CREEK SEDIMENTS

Chemical Group	Chemical	Number of Samples
Volatile Organics	1,1-Dichloroethane	28
(Continued)	1,1-Dichloroethene	28
	1,2,3-Trichloropropane	28
	1,2-Dichloroethane	28
	1,2-Dichloropropane	28
	2-Butanone (MEK)	28
	2-Chloroethyl vinyl ether	28
	2-Hexanone	28
	4-Methyl-2-pentanone (MIBK)	28
	Acrolein	25
	Acrylonitrile	28
	Benzene	28
	Bromodichloromethane	28
	Bromoform	28
	Bromomethane	28
	Carbon tetrachloride	28
	Chlorobenzene	28
	Chloroethane	28
	Chloroform	28
	Dibromochloromethane	28
	Dibromomethane	28
	Dichlorodifluoromethane	28
	Ethanol	25
	Ethyl methacrylate	28
	Iodomethane	28
	Tetrachloroethene	28
	Trichloroethene	28
	Trichlorofluoromethane	28
	Vinyl acetate	28
	Xylenes (total)	28
	cis-1,3-Dichloropropene	28
	trans-1,2-Dichloroethene	28
	trans-1,3-Dichloropropene	28
	trans-1,4-Dichloro-2-butene	28

TABLE 2-7

CHEMICALS NOT DETECTED IN OFF-BASE WEST SOLDIER CREEK SEDIMENTS

Chemical Group	Chemical	Number of Samples
Metals	Selenium	4
	Thallium	4
Pesticides/PCBs	4,4'-DDD	4
	4,4'-DDE	4
	4,4'-DDT	4
	Aldrin	4
	Aroclor 1016	4
	Aroclor 1221	4
	Aroclor 1232	4
	Aroclor 1242	4
	Aroclor 1248	4
	Aroclor 1260	4
	Dieldrin	4
	Endosulfan I	4
	Endosulfan II	4
	Endosulfan sulfate	4
	Endrin	4
	Heptachlor	4
	Heptachlor epoxide	4
	Methoxychlor	4
	Toxaphene	4
	alpha-BHC	4
	alpha-Chlordane	4
	beta-BHC	4
	delta-BHC	4
	gamma-BHC (Lindane)	4
	gamma-Chlordane	4
Semivolatile Organics	1,2,4,5-Tetrachloro-benzene	4
	1,2,4-Trichlorobenzene	4
	1,2-Dichlorobenzene	4
	1,3-Dichlorobenzene	4
	1,4-Dichlorobenzene	4
	1-Chloronaphthalene	4
	1-Naphthylamine	4
	2,2'-oxybis(1-Chloropropane)	4
	2,3,4,6-Tetrachlorophenol	4
	2,4,5-Trichlorophenol	4
	2,4,6-Trichlorophenol	4
	2,4-Dichlorophenol	4
	2,4-Dimethylphenol	4
	2,4-Dinitrophenol	4
	2,4-Dinitrotoluene	4
	2,6-Dichlorophenol	4
	2,6-Dinitrotoluene	4
	2-Chloronaphthalene	4
	2-Chlorophenol	4

TABLE 2-7

CHEMICALS NOT DETECTED IN OFF-BASE WEST SOLDIER CREEK SEDIMENTS

Chemical Group	Chemical	Number of Samples
Semivolatile Organics	2-Methylphenol	4
(Continued)	2-Naphthylamine	4
	2-Nitrophenol	4
	2-Picoline	4
	3,3'-Dichlorobenzidine	4
	3-Methylcholanthrene	4
	3-Nitroaniline	4
	3/4-Methylphenol	4
	4,6-Dinitro-2-methylphenol	4
	4-Aminobiphenyl	4
	4-Bromophenyl phenyl ether	4
	4-Chloro-3-methylphenol	4
	4-Chloroaniline	4
	4-Chlorophenyl phenyl ether	4
	4-Nitroaniline	4
	4-Nitrophenol	4
	7,12-Dimethylbenz(a)-anthracene	4
	Acenaphthylene	4
	Acetophenone	4
	Aniline	4
	Azobenzene	4
	Benzidine	4
	Benzoic acid	4
	Benzyl alcohol	4
	Di-n-butyl phthalate	4
	Diethyl phthalate	4
	Dimethyl phthalate	4
	Diphenylamine	4
	Ethyl methanesulfonate	4
	Hexachlorobenzene	4
	Hexachlorobutadiene	4
	Hexachlorocyclopentadiene	4
	Hexachloroethane	4
	Isophorone	4
	Methyl methanesulfonate	4
	N-Nitroso-di-n-butylamine	4
	N-Nitroso-di-n-propylamine	4
	N-Nitrosodiphenylamine	4
	N-Nitrosopiperidine	4
	Nitrobenzene	4
	Pentachlorobenzene	4
	Pentachloronitrobenzene	4
	Pentachlorophenol	4
	Phenacetin	4
	Phenol	4
	Pronamide	4

TABLE 2-7

CHEMICALS NOT DETECTED IN OFF-BASE WEST SOLDIER CREEK SEDIMENTS

Chemical Group	Chemical	Number of Samples
Semivolatile Organics	a,a-Dimethylphenethyl-amine	4
(Continued)	bis(2-Chloroethoxy)methane	4
	bis(2-Chloroethyl) ether	4
	p-Dimethylaminoazobenzene	4
Volatile Organics	1,1,1,2-Tetrachloroethane	4
	1,1,1-Trichloroethane	4
	1,1,2,2-Tetrachloroethane	4
	1,1,2-Trichloroethane	4
	1,1-Dichloroethane	4
	1,1-Dichloroethene	4
	1,2,3-Trichloropropane	4
	1,2-Dichloroethane	4
	1,2-Dichloropropane	4
	2-Butanone (MEK)	4
	2-Chloroethyl vinyl ether	4
	2-Hexanone	4
	4-Methyl-2-pentanone (MIBK)	4
	Acrolein	4
	Acrylonitrile	4
	Benzene	4
	Bromodichloromethane	4
	Bromoform	4
	Bromomethane	4
	Carbon disulfide	4
	Carbon tetrachloride	4
	Chlorobenzene	4
	Chloroethane	4
	Chloroform	4
	Chloromethane	4
	Dibromochloromethane	4
	Dibromomethane	4
	Dichlorodifluoromethane	4
	Ethanol	4
	Ethyl methacrylate	4
	Ethylbenzene	4
	Iodomethane	4
	Styrene	4
	Tetrachloroethene	4
	Toluene	4
	Trichloroethene	4
	Trichlorofluoromethane	4
	Vinyl acetate	4
	Vinyl chloride	4
	Xylenes (total)	4
	cis-1,3-Dichloropropene	4
	trans-1,2-Dichloroethene	4

TABLE 2-7

CHEMICALS NOT DETECTED IN OFF-BASE WEST SOLDIER CREEK SEDIMENTS

Chemical Group	Chemical	Number of Samples
Volatile Organics	trans-1,3-Dichloropropene	4
(Continued)	trans-1,4-Dichloro-2-butene	4

TABLE 2-8

CHEMICALS NOT DETECTED IN ON-BASE EAST SOLDIER CREEK SEDIMENTS

Chemical Group	Chemical	Number of Samples
Pesticides/PCBs	4,4'-DDE	31
	4,4'-DDT	31
	Aroclor 1016	31
	Aroclor 1221	31
	Aroclor 1232	31
	Aroclor 1242	31
	Aroclor 1248	31
	Dieldrin	31
	Endosulfan I	31
	Endosulfan sulfate	31
	Endrin	31
	Heptachlor epoxide	31
	Methoxychlor	31
	Toxaphene	31
	alpha-BHC	31
	beta-BHC	31
	delta-BHC	31
	gamma-BHC (Lindane)	31
Semivolatile Organics	1,2,4,5-Tetrachloro-benzene	31
	1,2,4-Trichlorobenzene	31
	1-Naphthylamine	31
	2,2'-oxybis(1-Chloropropane)	31
	2,3,4,6-Tetrachlorophenol	31
	2,4,5-Trichlorophenol	31
	2,4,6-Trichlorophenol	31
	2,4-Dichlorophenol	31
	2,4-Dinitrophenol	31
	2,4-Dinitrotoluene	31
	2,6-Dichlorophenol	31
	2,6-Dinitrotoluene	31
	2-Chlorophenol	31
	2-Methylphenol	31
	2-Naphthylamine	31
	2-Nitrophenol	31
	2-Picoline	31
	3,3'-Dichlorobenzidine	31
	3-Nitroaniline	31
	3/4-Methylphenol	31
	4,6-Dinitro-2-methylphenol	31
	4-Aminobiphenyl	31
	4-Bromophenyl phenyl ether	31
	4-Chloro-3-methylphenol	31
	4-Chloroaniline	31
	4-Chlorophenyl phenyl ether	31
	4-Nitroaniline	31
	4-Nitrophenol	31

TABLE 2-8

CHEMICALS NOT DETECTED IN ON-BASE EAST SOLDIER CREEK SEDIMENTS

Chemical Group	Chemical	Number of Samples
Semivolatile Organics	7,12-Dimethylbenz(a)-anthracene	31
(Continued)	Acenaphthylene	31
	Aniline	31
	Azobenzene	31
	Benzidine	31
	Benzyl alcohol	31
	Di-n-octyl phthalate	31
	Diethyl phthalate	31
	Dimethyl phthalate	31
	Diphenylamine	31
	Ethyl methanesulfonate	31
	Hexachlorobenzene	31
	Hexachlorobutadiene	31
	Hexachlorocyclopentadiene	31
	Hexachloroethane	31
	Isophorone	31
	Methyl methanesulfonate	31
	N-Nitroso-di-n-butylamine	31
	N-Nitroso-di-n-propylamine	31
	N-Nitrosodiphenylamine	31
	N-Nitrosopiperidine	31
	Nitrobenzene	31
	Pentachlorobenzene	31
	Pentachloronitrobenzene	31
	Pentachlorophenol	31
	Phenacetin	31
	Phenol	31
	Pronamide	31
	a,a-Dimethylphenethyl-amine	31
	bis(2-Chloroethoxy)methane	31
	bis(2-Chloroethyl) ether	31
	p-Dimethylaminoazobenzene	31
Volatile Organics	1,1,1,2-Tetrachloroethane	31
	1,1,1-Trichloroethane	31
	1,1,2-Trichloroethane	31
	1,1-Dichloroethene	31
	1,2,3-Trichloropropane	31
	1,2-Dichloroethane	31
	1,2-Dichloropropane	31
	2-Chloroethyl vinyl ether	31
	2-Hexanone	31
	4-Methyl-2-pentanone (MIBK)	31
	Acrolein	31
	Acrylonitrile	31
	Bromodichloromethane	31
	Bromoform	31

TABLE 2-8

CHEMICALS NOT DETECTED IN ON-BASE EAST SOLDIER CREEK SEDIMENTS

Chemical Group	Chemical	Number of Samples
Volatile Organics	Bromomethane	31
(Continued)	Carbon tetrachloride	31
	Chloroethane	31
	Chloroform	31
	Dibromochloromethane	31
	Dibromomethane	31
	Dichlorodifluoromethane	31
	Ethanol	31
	Ethyl methacrylate	31
	Iodomethane	31
	Tetrachloroethene	31
	Trichlorofluoromethane	31
	Vinyl acetate	31
	cis-1,3-Dichloropropene	31
	trans-1,2-Dichloroethene	31
	trans-1,3-Dichloropropene	31
	trans-1,4-Dichloro-2-butene	31

TABLE 2-9

CHEMICALS NOT DETECTED IN OFF-BASE EAST SOLDIER CREEK SEDIMENTS

Chemical Group	Chemical	Number of Samples
Metals	Selenium	9
Pesticides/PCBs	4,4'-DDD	9
	4,4'-DDE	9
	4,4'-DDT	9
	Aldrin	9
	Aroclor 1016	9
	Aroclor 1221	9
	Aroclor 1232	9
	Aroclor 1242	9
	Aroclor 1248	9
	Aroclor 1254	9
	Aroclor 1260	9
	Endosulfan I	9
	Endosulfan sulfate	9
	Endrin	9
	Heptachlor	9
	Heptachlor epoxide	9
	Methoxychlor	9
	Toxaphene	9
	alpha-BHC	9
	alpha-Chlordane	9
	beta-BHC	9
	delta-BHC	9
	gamma-BHC (Lindane)	9
	gamma-Chlordane	9
Semivolatile Organics	1,2,4,5-Tetrachloro-benzene	9
	1,2,4-Trichlorobenzene	9
	1,2-Dichlorobenzene	9
	1,3-Dichlorobenzene	9
	1-Naphthylamine	9
	2,2'-oxybis(1-Chloropropane)	9
	2,3,4,6-Tetrachlorophenol	9
	2,4,5-Trichlorophenol	9
	2,4,6-Trichlorophenol	9
	2,4-Dichlorophenol	9
	2,4-Dimethylphenol	9
	2,4-Dinitrophenol	9
	2,4-Dinitrotoluene	9
	2,6-Dichlorophenol	9
	2,6-Dinitrotoluene	9
	2-Chloronaphthalene	9
	2-Chlorophenol	9
	2-Methylphenol	9
	2-Naphthylamine	9
	2-Nitrophenol	9
	2-Picoline	9

TABLE 2-9

CHEMICALS NOT DETECTED IN OFF-BASE EAST SOLDIER CREEK SEDIMENTS

Chemical Group	Chemical	Number of Samples
Semivolatile Organics	3,3'-Dichlorobenzidine	9
(Continued)	3-Methylcholanthrene	9
	3-Nitroaniline	9
	3/4-Methylphenol	9
	4,6-Dinitro-2-methylphenol	9
	4-Aminobiphenyl	9
	4-Bromophenyl phenyl ether	9
	4-Chloro-3-methylphenol	9
	4-Chloroaniline	9
	4-Chlorophenyl phenyl ether	9
	4-Nitroaniline	9
	4-Nitrophenol	9
	7,12-Dimethylbenz(a)-anthracene	9
	Acenaphthene	9
	Acenaphthylene	9
	Acetophenone	9
	Aniline	9
	Anthracene	9
	Azobenzene	9
	Benzidine	9
	Benzo(a)anthracene	9
	Benzo(a)pyrene	9
	Benzo(g,h,i)perylene	9
	Benzo(k)fluoranthene	9
	Benzoic acid	9
	Benzyl alcohol	9
	Butyl benzyl phthalate	9
	Di-n-butyl phthalate	9
	Di-n-octyl phthalate	9
	Dibenz(a,h)anthracene	9
	Dibenzofuran	9
	Diethyl phthalate	9
	Dimethyl phthalate	9
	Diphenylamine	9
	Ethyl methanesulfonate	9
	Fluorene	9
	Hexachlorobenzene	9
	Hexachlorobutadiene	9
	Hexachlorocyclopentadiene	9
	Hexachloroethane	9
	Indeno(1,2,3-cd)pyrene	9
	Methyl methanesulfonate	9
	N-Nitroso-di-n-butylamine	9
	N-Nitroso-di-n-propylamine	9
	N-Nitrosodiphenylamine	9
	N-Nitrosopiperidine	9

TABLE 2-9

CHEMICALS NOT DETECTED IN OFF-BASE EAST SOLDIER CREEK SEDIMENTS

Chemical Group	Chemical	Number of Samples
Semivolatile Organics	Naphthalene	9
(Continued)	Nitrobenzene	9
	Pentachlorobenzene	9
	Pentachloronitrobenzene	9
	Pentachlorophenol	9
	Phenacetin	9
	Phenol	9
	Pronamide	9
	a,a-Dimethylphenethyl-amine	9
	bis(2-Chloroethoxy)methane	9
	bis(2-Chloroethyl) ether	9
	p-Dimethylaminoazobenzene	9
Volatile Organics	1,1,1,2-Tetrachloroethane	9
	1,1,1-Trichloroethane	9
	1,1,2,2-Tetrachloroethane	9
	1,1,2-Trichloroethane	9
	1,1-Dichloroethane	9
	1,1-Dichloroethene	9
	1,2,3-Trichloropropane	9
	1,2-Dichloroethane	9
	1,2-Dichloropropane	9
	2-Chloroethyl vinyl ether	9
	2-Hexanone	9
	4-Methyl-2-pentanone (MIBK)	9
	Acrolein	9
	Acrylonitrile	9
	Benzene	9
	Bromodichloromethane	9
	Bromoform	9
	Bromomethane	9
	Carbon tetrachloride	9
	Chloroethane	9
	Chloroform	9
	Chloromethane	9
	Dibromochloromethane	9
	Dibromomethane	9
	Dichlorodifluoromethane	9
	Ethanol	9
	Ethyl methacrylate	9
	Ethylbenzene	9
	Iodomethane	9
	Styrene	9
	Tetrachloroethene	9
	Toluene	9
	Trichloroethene	9
	Trichlorotluoromethane	9

TABLE 2-9

CHEMICALS NOT DETECTED IN OFF-BASE EAST SOLDIER CREEK SEDIMENTS

Chemical Group	Chemical	Number of Samples
Volatile Organics	Vinyl acetate	9
(Continued)	Vinyl chloride	9
	Xylenes (total)	9
	cis-1,3-Dichloropropene	9
	trans-1,2-Dichloroethene	9
	trans-1,3-Dichloropropene	9
	trans-1,4-Dichloro-2-butene	9

TABLE 2-10

CHEMICALS DETECTED AT LOW FREQUENCY AND CONCENTRATION ON-BASE WEST SOLDIER CREEK SEDIMENTS

Group	Chemical	Maximum Concentration (mg/kg)	Frequency
Pesticides/PCBs	4,4'-DDE	0.0085	1/28
	Heptachlor epoxide	0.0028	1/28
Semivolatile Organics	Acenaphthylene*	0.043	1/28
	Di-butyl phthalate	0.2	1/28
	Di-n-octylphthalate	0.5	1/28
Volatile Organics	Carbon Disulfide	0.0057	1/28
	Chloromethane	0.004	1/28
	Vinyl Chloride	0.0028	1/28

*Pyrene was used as a surrogate compound for RBC screening of acenaphthylene. The maximum detected concentration of acenaphthylene was below the Region III RBC for industrial soils. Therefore, acenaphthylene was not retained as a COC.

**Maximum detected concentration exceeded the Region III RBC concentration for industrial soils. Therefore, the chemical is retained as a COC.

TABLE 2-11

CHEMICALS DETECTED AT LOW FREQUENCY AND CONCENTRATION ON-BASE EAST SOLDIER CREEK SEDIMENTS

Group	Chemical	Maximum Concentration (mg/kg)	Frequency
Pesticides/PCBs	Heptachlor	0.0081	1/31
Semivolatile Organics	1,3-Dichlorobenzene	0.38	1/31
Volatile Organics	Vinyl chloride	0.0013	1/31

TABLE 2-12

ESSENTIAL NUTRIENTS EXCLUDED AS POTENTIAL COCs ON-BASE WEST SOLDIER CREEK SURFACE WATER

Chemical	Surface Water Concentration[a] (mg/L)	Daily Ingestion[b] (mg/day)	RDA[c] (mg/day)
Calcium	62.9	31.45	1200
Chromium	0.0016	0.0008	0.2
Copper	0.0072	0.0036	3
Magnesium	14.3	7.15	400
Manganese	0.24	0.12	5
Molybdenum	0.02	0.01	0.25
Potassium	10.1	5.05	390-780[d]
Selenium	0.0018	0.0009	0.075
Sodium	16.8	8.4	1000[e]
Zinc	0.036	0.018	15

Note:

a. Maximum detected concentration.

b. Assumes an individual who ingests 0.5 L/day of surface water.

c. Recommended Daily Allowance established by the National Research Council (1989).

d. Recommended potassium intake is based on body weight. For a small child weighing 10kg, the recommended intake is 390-780 mg/day.

e. Sodium is recognized as an essential nutrient, but there is no RDA value. Ingestion of less than 1,000 mg/day is considered a sodium-restricted diet. The average dietary intake of sodium in the U.S. is greater than 10,000 mg/day (Nelson, 1992).

TABLE 2-13

ESSENTIAL NUTRIENTS EXCLUDED AS POTENTIAL COCs OFF-BASE WEST SOLDIER CREEK SURFACE WATER

Chemical	Surface Water Concentration[a] (mg/L)	Daily Ingestion[b] (mg/day)	RDA[c] (mg/day)
Calcium	59.1	29.55	1200
Chromium	0.0049	0.00245	0.2
Copper	0.016	0.008	3
Magnesium	27.5	13.75	400
Manganese	0.0042	0.0021	5
Molybdenum	0.0083	0.00415	0.25
Potassium	1.6	0.8	390-780[d]
Selenium	0.001	0.0005	0.075
Sodium	29.8	14.9	1000[e]
Zinc	0.042	0.021	15

Note:

a. Maximum detected concentration.

b. Assumes an individual who ingests 0.5 L/day of surface water.

c. Recommended Daily Allowance established by the National Research Council (1989).

d. Recommended potassium intake is based on body weight. For a small child weighing 10kg, the recommended intake is 390-780 mg/day.

e. Sodium is recognized as an essential nutrient, but there is no RDA value. Ingestion of less than 1,000 mg/day is considered a sodium-restricted diet. The average dietary intake of sodium in the U.S. is greater than 10,000 mg/day (Nelson, 1992).

TABLE 2-14

ESSENTIAL NUTRIENTS EXCLUDED AS POTENTIAL COCs ON-BASE EAST SOLDIER CREEK SURFACE WATER

Chemical	Surface Water Concentration[a] (mg/L)	Daily Ingestion[b] (mg/day)	RDA[c] (mg/day)
Calcium	72.4	36.2	1,200
Chromium (total)	0.045	0.0225	0.2
Chromium VI	0.01	0.005	0.2
Copper	0.51	0.255	3
Magnesium	36.1	18.05	400
Manganese	0.097	0.0485	5
Molybdenum	0.0031	0.00155	0.25
Potassium	2.7	1.35	390-780[d]
Selenium	0.0042	0.0021	0.075
Sodium	29.3	14.65	1,000[e]
Zinc	0.075	0.0375	15

Note:

a. Maximum detected concentration.

b. Assumes an individual who ingests 0.5 L/day of surface water.

c. Recommended Daily Allowance established by the National Research Council (1989).

d. Recommended potassium intake is based on body weight. For a small child weighing 10kg, the recommended intake is 390-780 mg/day.

e. Sodium is recognized as an essential nutrient, but there is no RDA value. Ingestion of less than 1,000 mg/day is considered a sodium-restricted diet. The average dietary intake of sodium in the U.S. is greater than 10,000 mg/day (Nelson, 1992).

TABLE 2-15

ESSENTIAL NUTRIENTS EXCLUDED AS POTENTIAL COCs
OFF-BASE EAST SOLDIER CREEK SURFACE WATER

Chemical	Surface Water Concentration[a] (mg/L)	Daily Ingestion[b] (mg/day)	RDA[c] (mg/day)
Calcium	64.8	32.4	1,200
Chromium	0.0084	0.0042	0.2
Copper	0.02	0.01	3
Magnesium	32.2	16.1	400
Manganese	0.06	0.03	5
Molybdenum	0.0025	0.00125	0.25
Potassium	2.4	1.2	390-780[d]
Selenium	0.0023	0.00115	0.075
Sodium	22.4	11.2	1,000[e]
Zinc	0.022	0.011	15

Note:

a. Maximum detected concentration.

b. Assumes an individual who ingests 0.5 L/day of surface water.

c. Recommended Daily Allowance established by the National Research Council (1989).

d. Recommended potassium intake is based on body weight. For a small child weighing 10kg, the recommended intake is 390-780 mg/day.

e. Sodium is recognized as an essential nutrient, but there is no RDA value. Ingestion of less than 1,000 mg/day is considered a sodium-restricted diet. The average dietary intake of sodium in the U.S. is greater than 10,000 mg/day (Nelson, 1992).

TABLE 2-16

ESSENTIAL NUTRIENTS EXCLUDED AS POTENTIAL COCs ON-BASE WEST SOLDIER CREEK SEDIMENTS

Chemical	Sediment Concentration[a] (mg/kg)	Daily Ingestion[b] (mg/day)	RDA[c] (mg/day)
Calcium	50900	5.09	1,200
Copper	2010	0.201	3
Iron	24400	2.44	30
Magnesium	23400	2.34	400
Manganese	7430	0.743	5
Molybdenum	262	0.0262	0.25
Potassium	3520	0.352	390-780[d]
Selenium	10.3	0.00103	0.075
Sodium	1090	0.109	1,000[e]
Zinc	2310	0.231	15

Note:

a. Maximum detected concentration.

b. Assumes an individual who ingests 100 mg of sediment per day.

c. Recommended Daily Allowance established by the National Research Council (1989).

d. Recommended potassium intake is based on body weight. For a small child weighing 10kg, the recommended intake is 390-780 mg/day.

e. Sodium is recognized as an essential nutrient, but there is no RDA value. Ingestion of less than 1,000 mg/day is considered a sodium-restricted diet. The average dietary intake of sodium in the U.S. is greater than 10,000 mg/day (Nelson, 1992).

TABLE 2-17

ESSENTIAL NUTRIENTS EXCLUDED AS POTENTIAL COCs OFF-BASE WEST SOLDIER CREEK SEDIMENTS

Chemical	Sediment Concentration[a] (mg/kg)	Daily Ingestion[b] (mg/day)	RDA[c] (mg/day)
Calcium	112000	11.2	1,200
Chromium	115	0.0115	0.2
Copper	17.2	0.00172	3
Iron	12500	1.25	30
Magnesium	7800	0.78	400
Manganese	934	0.0934	5
Molybdenum	4.9	0.00049	0.25
Potassium	696	0.0696	390-780[d]
Sodium	242	0.0242	1,000[e]
Zinc	81.1	0.00811	15

Note:

a. Maximum detected concentration.

b. Assumes an individual who ingests 100 mg of sediment per day.

c. Recommended Daily Allowance established by the National Research Council (1989).

d. Recommended potassium intake is based on body weight. For a small child weighing 10kg, the recommended intake is 390-780 mg/day.

e. Sodium is recognized as an essential nutrient, but there is no RDA value. Ingestion of less than 1,000 mg/day is considered a sodium-restricted diet. The average dietary intake of sodium in the U.S. is greater than 10,000 mg/day (Nelson, 1992).

TABLE 2-18

ESSENTIAL NUTRIENTS EXCLUDED AS POTENTIAL COCs ON-BASE EAST SOLDIER CREEK SEDIMENTS

Chemical	Sediment Concentration[a] (mg/kg)	Daily Ingestion[b] (mg/day)	RDA[c] (mg/day)
Calcium	121000	12.1	1,200
Copper	581	0.0581	3
Iron	14400	1.44	30
Magnesium	6920	0.692	400
Manganese	1830	0.183	5
Molybdenum	41.8	0.00418	.25
Potassium	1400	0.14	390-780[d]
Selenium	7.5	0.00075	0.075
Sodium	177	0.0177	1,000[e]
Zinc	671	0.0671	15

Note:

a. Maximum detected concentration.

b. Assumes an individual who ingests 100 mg of sediment per day.

c. Recommended Daily Allowance established by the National Research Council (1989).

d. Recommended potassium intake is based on body weight. For a small child weighing 10kg, the recommended intake is 390-780 mg/day.

e. Sodium is recognized as an essential nutrient, but there is no RDA value. Ingestion of less than 1,000 mg/day is considered a sodium-restricted diet. The average dietary intake of sodium in the U.S. is greater than 10,000 mg/day (Nelson, 1992).

TABLE 2-19

ESSENTIAL NUTRIENTS EXCLUDED AS POTENTIAL COCs
OFF-BASE EAST SOLDIER CREEK SEDIMENTS

Chemical	Sediment Concentration[a] (mg/kg)	Daily Ingestion[b] (mg/day)	RDA[c] (mg/day)
Calcium	141000	14.1	1,200
Chromium	220	0.022	0.2
Copper	34.2	0.00342	3
Iron	18500	1.85	30
Magnesium	27100	2.71	400
Manganese	1890	0.189	5
Molybdenum	7.2	0.00072	0.25
Potassium	964	0.0964	390-780[d]
Sodium	159	0.0159	1,000[e]
Zinc	91.5	0.00915	15

Note:

a. Maximum detected concentration.

b. Assumes an individual who ingests 100 mg of sediment per day.

c. Recommended Daily Allowance established by the National Research Council (1989).

d. Recommended potassium intake is based on body weight. For a small child weighing 10kg, the recommended intake is 390-780 mg/day.

e. Sodium is recognized as an essential nutrient, but there is no RDA value. Ingestion of less than 1,000 mg/day is considered a sodium-restricted diet. The average dietary intake of sodium in the U.S. is greater than 10,000 mg/day (Nelson, 1992).

TABLE 2-20

CHEMICALS DETECTED AT BACKGROUND LEVELS ON-BASE WEST SOLDIER CREEK SURFACE WATER

Chemical	Background Concentration[a] (mg/L)	2x Background Concentration (mg/L)	Maximum Detected Concentration (mg/L)
Aluminum	4.37	8.74	0.73
Barium	0.739	1.478	0.3
Iron	2.96	5.92	1.9
Lead	0.012	0.024	0.0018

Note:

a. Samples from off-base Crutcho Creek were used to identify background concentrations.

TABLE 2-21

CHEMICALS DETECTED AT BACKGROUND LEVELS OFF-BASE WEST SOLDIER CREEK SURFACE WATER

Chemical	Background Concentration[a] (mg/L)	2x Background Concentration (mg/L)	Maximum Detected Concentration (mg/L)
Aluminum	4.37	8.74	0.044
Barium	0.739	1.478	0.45
Iron	2.96	5.92	0.066
Lead	0.012	0.024	0.0008

Note:

a. Samples from off-base Crutcho Creek were used to identify background concentrations.

TABLE 2-22

CHEMICALS DETECTED AT BACKGROUND LEVELS ON-BASE EAST SOLDIER CREEK SURFACE WATER

Chemical	Background Concentration[a] (mg/L)	2x Background Concentration (mg/L)	Maximum Detected Concentration (mg/L)
Aluminum	4.37	8.74	0.49
Barium	0.739	1.478	0.62
Iron	2.96	5.92	1
Lead	0.012	0.024	0.015

Note:

a. Samples from off-base Crutcho Creek were used to identify background concentrations.

TABLE 2-23

CHEMICALS DETECTED AT BACKGROUND LEVELS OFF-BASE EAST SOLDIER CREEK SURFACE WATER

Chemical	Background Concentration[a] (mg/L)	2x Background Concentration (mg/L)	Maximum Detected Concentration (mg/L)
Aluminum	4.37	8.74	0.16
Barium	0.739	1.478	0.53
Iron	2.96	5.92	0.4
Lead	0.012	0.024	0.0021

Note:

a. Samples from off-base Crutcho Creek were used to identify background concentrations.

TABLE 2-24

CHEMICALS DETECTED AT BACKGROUND LEVELS ON-BASE WEST SOLDIER CREEK SEDIMENTS

Chemical	Background Concentration[a] (mg/kg)	2 x Background Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)
Aluminum	17100	34200	22700
Arsenic	14	28	9.7
Barium	2620	5240	771
Iron	70600	141200	24400

Note:

a. Samples from off-base Crutcho Creek were used to identify background concentrations.

TABLE 2-25

CHEMICALS DETECTED AT BACKGROUND LEVELS OFF-BASE WEST SOLDIER CREEK SEDIMENTS

Chemical	Background Concentration[a] (mg/kg)	2x Background Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)
Aluminum	17100	34200	2810
Arsenic	14	28	1.8
Barium	2620	5240	631
Nickel	110	220	150

Note:

a. Samples from off-base Crutcho Creek were used to identify background concentrations.

TABLE 2-26

CHEMICALS DETECTED AT BACKGROUND LEVELS ON-BASE EAST SOLDIER CREEK SEDIMENTS

Chemical	Background Concentration[a] (mg/kg)	2x Background Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)
Aluminum	17100	34200	9210
Arsenic	. 14	28	15.7
Barium	2620	5240	2370

Note:

a. Samples from off-base Crutcho Creek were used to identify background concentrations.

TABLE 2-27

CHEMICALS DETECTED AT BACKGROUND LEVELS OFF-BASE EAST SOLDIER CREEK SEDIMENTS

Chemical	Background Concentration[a] (mg/kg)	2x Background Concentration (mg/kg)	Maximum Detected Concentration (mg/kg)
Aluminum	17100	34200	6830
Arsenic	14	28	4.7
Barium	2620	5240	3200
Lead	44	88	47.9
Nickel	110	220	96.5
Silver	7	14	5.8

Note:

a. Samples from off-base Crutcho Creek were used to identify background concentrations.

TABLE 2-28

CHEMICALS OF CONCERN
ON-BASE WEST SOLDIER CREEK SURFACE WATER

Chemical	Maximum Detected Concentration (mg/L)	Minimum Detected Concentration (mg/L)	Frequency of Detection
Metals			
Antimony	0.00055	0.00013	2/3
Arsenic	0.0038	0.0038	1/3
Cadmium	0.00088	0.000074	2/3
Cobalt	0.0018	0.00017	3/3
Nickel	0.052	0.0068	3/3
Vanadium	0.0049	0.0008	3/3
Semivolatile Organics			
bis(2-Ethylhexyl)phthalate	0.0043	0.0043	1/3
Volatile Organics			
Acetone	0.0037	0.0037	1/3
Chloromethane	0.0011	0.0011	1/3
Styrene	0.0034	0.0034	1/3

TABLE 2-29

CHEMICALS OF CONCERN
OFF-BASE WEST SOLDIER CREEK SURFACE WATER

Chemical	Maximum Detected Concentration (mg/L)	Minimum Detected Concentration (mg/L)	Frequency of Detection
Metals			
Antimony	0.00044	0.00028	2/4
Cadmium	0.00052	0.0002	4/4
Cobalt	0.00036	0.000026	4/4
Nickel	0.016	0.00026	4/4
Vanadium	0.016	0.0055	3/4
Volatile Organics			
Acetone	0.0055	0.0055	1/4
Bromomethane	0.0072	0.0072	1/4
Chloromethane	0.0036	0.0021	2/4
Iodomethane	0.0018	0.0012	2/4
Methylene chloride	0.0014	0.0014	1/4

TABLE 2-30

CHEMICALS OF CONCERN
ON-BASE EAST SOLDIER CREEK SURFACE WATER

Chemical	Maximum Detected Concentration (mg/L)	Minimum Detected Concentration (mg/L)	Frequency of Detection
Metals			
Antimony	0.00025	0.00004	6/18
Arsenic	0.0027	0.0022	3/18
Cadmium	0.016	0.000073	15/18
Cobalt	0.00096	0.0001	18/18
Nickel	0.02	0.0021	18/18
Silver	0.00062	0.00013	2/18
Vanadium	0.018	0.0084	18/18
Pesticides/PCBs			
Aroclor 1254	0.00058	0.00058	1/18
Semivolatile Organics			
bis(2-Ethylhexyl)phthalate	0.012	0.0029	5/18
Volatile Organics			
Acetone	0.012	0.003	8/18
Bromoform	0.0016	0.0016	1/18
Dibromochloromethane	0.0018	0.0018	1/18
Ethanol	0.041	0.041	1/18
Methylene chloride	0.0013	0.001	4/18

TABLE 2-31

CHEMICALS OF CONCERN
OFF-BASE EAST SOLDIER CREEK SURFACE WATER

Chemical	Maximum Detected Concentration (mg/L)	Minimum Detected Concentration (mg/L)	Frequency of Detection
Metals			
Antimony	0.00029	0.00022	2/4
Arsenic	0.0028	0.0023	4/4
Cadmium	0.0013	0.0006	3/3
Cobalt	0.0004	0.00033	3/3
Nickel	0.012	0.0054	3/3
Vanadium	0.016	0.0088	3/3
Semivolatile Organics			
bis(2-Ethylhexyl)phthalate	0.005	0.0041	2/4
Volatile Organics			
Acetone	0.0041	0.0041	1/4

TABLE 2-32

CHEMICALS OF CONCERN
ON-BASE WEST SOLDIER CREEK SEDIMENTS

Chemical	Maximum Detected Concentration (mg/kg)	Minimum Detected Concentration (mg/kg)	Frequency of Detection
Metals			
Antimony	11	4.8	2/28
Beryllium	1.7	0.29	27/28
Cadmium	210	0.57	17/28
Chromium	4000	11	28/28
Cobalt	170	2.4	28/28
Lead	930	4.9	28/28
Mercury	0.55	0.016	14/28
Nickel	6500	6.6	28/28
Silver	730	0.43	19/28
Thallium	130	14	13/28
Vanadium	120	7.1	28/28
Pesticides/PCBs			
4,4'-DDE*	0.0085	0.0085	1/28
Aldrin	0.0067	0.0025	2/28
Aroclor 1254	82	0.063	10/28
Heptachlor epoxide*	0.0028	0.0028	1/28
Semivolatile Organics			
1,2-Dichlorobenzene	1.6	1.2	2/28
2-Methylnaphthalene	0.85	0.41	2/28
Acenaphthene	1.1	0.044	3/28
Anthracene	1.6	0.043	5/28
Benzidine	0.22	0.22	1/28
Benzo(a)anthracene	5.7	0.046	16/28
Benzo(a)pyrene	5.8	0.05	17/28
Benzo(b)fluoranthene	5.6	0.052	17/28
Benzo(g,h,i)perylene	5.3	0.046	16/28
Benzo(k)fluoranthene	9.5	0.053	17/28
Chrysene	7	0.068	17/28
Di-n-butyl phthalate*	0.2	0.2	1/28
Dibenz(a,h)anthracene	1.6	0.057	6/28
Dibenzofuran	1.1	0.79	2/28
Fluoranthene	21	0.074	18/28
Fluorene	1.4	1	2/28
Indeno(1,2,3-cd)pyrene	4.7	0.047	15/28
Naphthalene	2.1	1.7	2/28
Phenanthrene	14	0.041	17/28
Pyrene	12	0.079	18/28
bis(2-Ethylhexyl)phthalate	0.14	0.048	6/28
Volatile Organics			
Acetone	0.089	0.0057	4/28
Carbon disulfide*	0.0057	0.0057	1/28
Chloromethane*	0.004	0.004	1/28
Ethylbenzene	0.053	0.0019	4/28
Methylene chloride	0.0018	0.0014	4/28

TABLE 2-32

CHEMICALS OF CONCERN
ON-BASE WEST SOLDIER CREEK SEDIMENTS

Chemical	Maximum Detected Concentration (mg/kg)	Minimum Detected Concentration (mg/kg)	Frequency of Detection
Styrene	0.5	0.0024	6/28
Toluene	0.034	0.0024	4/28
Vinyl chloride*	0.0028	0.0028	1/28

*These chemicals were only detected in the 0.5-foot level. They are evaluated in the current exposure scenario only because when combined with all depths for the future exposure scenario, they were eliminated based on low frequency of detection and low concentration.

TABLE 2-33

CHEMICALS OF CONCERN
OFF-BASE WEST SOLDIER CREEK SEDIMENTS

Chemical	Maximum Detected Concentration (mg/kg)	Minimum Detected Concentration (mg/kg)	Frequency of Detection
Metals			
Antimony	4.4	4.4	1/4
Beryllium	0.51	0.27	2/4
Cadmium	17	1.2	4/4
Chromium (VI)	8.4	8.4	1/4
Cobalt	7.3	6.1	4/4
Lead	250	7.1	4/4
Mercury	0.055	0.013	2/4
Silver	16	0.56	4/4
Vanadium	23	10	4/4
Pesticides/PCBs			
Aroclor 1254	6	0.23	4/4
Semivolatile Organics			
2-Methylnaphthalene	0.28	0.28	1/4
Acenaphthene	2	2	1/4
Anthracene	3.2	3.2	1/4
Benzo(a)anthracene	9.9	0.098	3/4
Benzo(a)pyrene	7.9	0.091	3/4
Benzo(b)fluoranthene	9.4	0.072	3/4
Benzo(g,h,i)perylene	3.9	0.042	3/4
Benzo(k)fluoranthene	8.3	0.1	3/4
Butyl benzyl phthalate	0.47	0.47	1/4
Chrysene	12	0.12	3/4
Di-n-octyl phthalate	0.66	0.66	1/4
Dibenz(a,h)anthracene	0.36	0.36	1/4
Dibenzofuran	1.2	1.2	1/4
Fluoranthene	27	0.057	4/4
Fluorene	2.2	2.2	1/4
Indeno(1,2,3-cd)pyrene	4.3	0.041	3/4
Naphthalene	0.69	0.69	1/4
Phenanthrene	21	0.12	3/4
Pyrene	25	0.054	4/4
bis(2-Ethylhexyl)phthalate	0.13	0.13	1/4
Volatile Organics			
Acetone	0.0056	0.0056	1/4
Methylene chloride	0.0018	0.0018	1/4

TABLE 2-34

CHEMICALS OF CONCERN
ON-BASE EAST SOLDIER CREEK SEDIMENTS

Chemical	Maximum Detected Concentration (mg/kg)	Minimum Detected Concentration (mg/kg)	Frequency of Detection
Metals			
Antimony	7.6	3.9	5/31
Beryllium	0.82	0.27	23/31
Cadmium	837	2.3	25/31
Chromium	2800	18	31/31
Cobalt	50.4	2.8	31/31
Lead	528	6.4	31/31
Mercury	8.3	0.036	30/31
Nickel	1360	9.7	31/31
Silver	15.2	0.44	25/31
Thallium	126	18.7	7/31
Vanadium	82.9	8.9	31/31
Pesticides/PCBs			
4,4'-DDD	0.042	0.031	3/31
Aldrin*	0.097	0.097	1/31
Aroclor 1254	14	0.054	8/31
Aroclor 1260*	0.068	0.068	1/31
Endosulfan II	0.093	0.05	3/31
alpha-Chlordane*	0.013	0.013	1/31
gamma-Chlordane	0.023	0.02	2/31
Semivolatile Organics			
1,2-Dichlorobenzene	0.22	0.13	2/31
1,4-Dichlorobenzene	1.1	0.051	3/31
1-Chloronaphthalene	0.23	0.06	4/31
2-Chloronaphthalene	0.5	0.053	8/31
2-Methylnaphthalene	4.5	0.048	10/31
2,4-Dimethylphenol*	0.064	0.064	1/31
3-Methylcholanthrene*	0.025	0.025	1/31
Acenaphthene	2.2	0.044	18/31
Acetophenone*	0.11	0.11	1/31
Anthracene	4.4	0.054	22/31
Benzo(a)anthracene	9.1	0.063	28/31
Benzo(a)pyrene	11	0.054	27/31
Benzo(b)fluoranthene	13	0.044	29/31
Benzo(g,h,i)perylene	4.5	0.046	29/31
Benzo(k)fluoranthene	12	0.055	28/31
Benzoic acid*	0.28	0.28	1/31
Butyl benzyl phthalate*	0.51	0.51	1/31
Chrysene	12	0.062	29/31
Di-n-butyl phthalate	0.3	0.044	4/31
Dibenz(a,h)anthracene	1.9	0.057	18/31
Dibenzofuran	1.5	0.041	14/31
Fluoranthene	32	0.053	30/31
Fluorene	2.5	0.053	19/31

TABLE 2-34

CHEMICALS OF CONCERN
ON-BASE EAST SOLDIER CREEK SEDIMENTS

Chemical	Maximum Detected Concentration (mg/kg)	Minimum Detected Concentration (mg/kg)	Frequency of Detection
Indeno(1,2,3-cd)pyrene	4.6	0.067	27/31
Naphthalene	4	0.046	15/31
Phenanthrene	18	0.067	29/31
Pyrene	17	0.058	30/31
bis(2-Ethylhexyl)phthalate	19	0.047	28/31
Volatile Organics			
1,1-Dichloroethane*	0.0016	0.0016	1/31
1,1,2,2-Tetrachloroethane*	0.0027	0.0027	1/31
2-Butanone (MEK)	0.048	0.0025	11/31
Acetone	0.26	0.0066	22/31
Benzene*	0.021	0.021	1/31
Carbon disulfide	0.0092	0.0015	5/31
Chlorobenzene	18	0.0014	18/31
Chloromethane	0.025	0.0038	2/31
Ethylbenzene	0.0081	0.0013	4/31
Methylene chloride	0.021	0.0015	7/31
Styrene	0.036	0.0019	5/31
Toluene	0.013	0.0015	2/31
Trichloroethene*	0.0019	0.0019	1/31
Xylenes (total)	0.0061	0.0015	4/31

*These chemicals were only detected in the 0.5-foot level. They are evaluated in the current exposure scenario only because when combined with all depths for the future exposure scenario, they were eliminated based on low frequency of detection and low concentration.

TABLE 2-35

CHEMICALS OF CONCERN
OFF-BASE EAST SOLDIER CREEK SEDIMENTS

Chemical	Maximum Detected Concentration (mg/kg)	Minimum Detected Concentration (mg/kg)	Frequency of Detection
Metals			
Antimony	4.8	4.8	1/9
Beryllium	0.67	0.6	4/9
Cadmium	25	2.4	6/9
Cobalt	8.1	1.2	9/9
Mercury	0.1	0.023	6/9
Thallium	130	17	7/9
Vanadium	27	5.3	9/9
Pesticides/PCBs			
Dieldrin	0.0021	0.0021	1/9
Endosulfan II	0.0021	0.0021	1/9
Semivolatile Organics			
1,4-Dichlorobenzene	0.042	0.042	1/9
1-Chloronaphthalene	0.049	0.046	2/9
2-Methylnaphthalene	0.13	0.13	1/9
Benzo(b)fluoranthene	0.04	0.04	1/9
Chrysene	0.047	0.044	2/9
Fluoranthene	0.83	0.086	6/9
Isophorone	0.47	0.47	1/9
Phenanthrene	0.064	0.064	1/9
Pyrene	0.28	0.085	4/9
bis(2-Ethylhexyl)phthalate	5.2	0.1	6/9
Volatile Organics			
2-Butanone (MEK)	0.0083	0.0036	2/9
Acetone	0.033	0.0098	4/9
Carbon disulfide	0.0045	0.0013	3/9
Chlorobenzene	0.15	0.019	2/9
Methylene chloride	0.0021	0.0017	2/9

3.0
EXPOSURE ASSESSMENT

The purpose of the exposure assessment is to estimate the magnitude of potential chemical exposure among various receptor populations. The steps required to perform an exposure assessment include the following:

- Identification of potential receptor populations
- Evaluation of potential exposure pathways for completeness
- Evaluation of potential exposure parameters
- Estimation of exposure point concentrations
- Estimation of daily intake factors

The approach of this RA was to incorporate conservative exposure assumptions when estimating the magnitude of potential exposure, so that potential risks posed by the site were not underestimated. At the same time, exposure scenarios which are considered unlikely were excluded, since they do not reflect realistic exposure conditions. It is important to note that for purposes of an RA, exposure can be defined for both reasonable maximum exposure (RME) and average exposure. The RME represents the most exposed individual in a population, while the average exposure represents the most likely exposure for the potentially exposed population. Both RME and average exposure scenarios were evaluated in this RA.

3.1 IDENTIFICATION OF POTENTIAL RECEPTOR POPULATIONS

Potential receptors include human, plant, and animal populations, as well as, environmental receptors (e.g., streams, ponds, and lakes) that may be exposed to site-related chemicals. An assessment of potentially exposed plant and animal populations were addressed under a separate evaluation (WCFS 1997a). Only potential human receptor populations were addressed in this RA. Populations evaluated include those individuals most likely to come into contact with contaminated surface water and sediments in the four stream segments currently being assessed.

Because Tinker AFB is an active military facility with restricted access, local off-Base populations cannot readily come into contact with the on-Base portions of East or West Soldier Creek. For most site workers or visitors, exposure to the on-Base portions of the creek is likely to be minimal, if at all. For the purposes of an RA, it was assumed that the population with the greatest potential for contact with surface water or sediment from the creek would be a construction worker involved in repair or installation of underground pipelines around or under the creek. Because land use at Tinker AFB is unlikely to change in the foreseeable future, this scenario is considered a maximum exposure scenario for both current and future use conditions (evaluation of the maximum exposed population provides a conservative estimation of risks for all potentially exposed populations).

Off-Base portions of East and West Soldier Creeks flow through several residential and nonresidential areas. Access to the creek in these areas is essentially unrestricted, therefore, a number of different receptors could potentially contact stream sediments and surface water. The receptor with the potential for maximum exposure is likely to be a local resident who swims or wades in the creek. This is particularly true for children, for whom the stream would act as an "attractive nuisance." Since a residential exposure scenario is highly conservative, evaluation of this scenario in the RA should be protective of local populations under both current and future use conditions.

Based on the discussion presented above, the populations evaluated quantitatively in the RA consisted of the following:

- On-Base construction worker
- Off-Base child resident
- Off-Base adult resident

3.2 EVALUATION OF POTENTIAL EXPOSURE PATHWAYS

An exposure pathway is the mechanism by which a receptor may come into contact with a chemical. As defined by the RAGS, there are four major elements that characterize a complete exposure pathway (EPA 1989a). These elements are:

- A source and mechanism of chemical release
- A transport medium for the chemical
- A point of potential receptor contact with the medium (i.e., an exposure point)
- A route of exposure (e.g., ingestion) for the receptor to come into contact with the chemical

For an exposure pathway to be complete, all four elements must be present. The absence of any one of these elements results in an incomplete exposure pathway for which site-related health risks do not exist. Thus, the evaluation of potential exposure pathways is necessary to focus on only those pathways that are complete and could potentially impact human health.

To develop a conceptual understanding of the sites and their potential to impact human health and environment, a site conceptual exposure model (SCEM) is developed. This model represents a theoretical exposure analysis and is used to identify complete exposure pathways. **Figure 3-1** depicts the site conceptual exposure model for the four stream segments of concern in Soldier Creek. This model specifically identifies chemical sources, release mechanisms, transport media, exposure routes, and receptor populations. Potential on-Base sources of chemical release were identified previously in **Section 1.1** (Site Description) and **2.0** (Chemicals of Concern). The mechanism of release refers to the physicochemical properties of the chemicals that influence their mobility and potential contact with a receptor. The presence and identification of receptors was discussed in **Section 3.1** (Identification of Potential Receptor Populations). An evaluation of potential exposure pathways identified in the SCEM is presented in the following sections.

3.2.1 Identification of Potential Sources of Chemical Release

Numerous on-Base and off-Base sources of chemical release have been identified in previous investigations (see B&V 1993, and NUS 1989 for detailed reviews). On-Base sources of contamination include:

- Outfalls from Building 3001
- Building 3001
- Southwest tank area
- North tank area
- IWTP (Inactivated April 1996)

Besides the on-Base sources of release, several potential off-Base sources have also been identified (B&V 1993):

- A paint shop
- A trailer park (northeast of Tinker AFB)
- An auto repair shop
- A service station
- A salvage yard

Because the on-Base sources differ in nature from the off-Base sources, it is likely that the on-Base receptors will be exposed to different chemical constituents and/or concentrations than off-Base receptors.

3.2.2 Identification of Potential Exposure Points and Exposure Routes

Exposure points are the locations where potentially exposed populations may contact contaminated media. In the present RA, surface water and sediments in East and West Soldier Creeks were the exposure points of concern. Groundwater exposure was evaluated separately and was not included in the current scope of this investigation.

Exposure routes are the mode of contact (inhalation, ingestion, or dermal contact) with the contaminated media. On-Base construction workers could be exposed to contaminants in on-Base portions of East and West Soldier Creek via incidental ingestion and dermal contact

with surface water and sediments while performing excavation activities or wading in the creek where the construction activities are occurring.

The water level in the off-Base portion of West Soldier Creek generally is very shallow and swimming is not possible. However, off-Base residents may be exposed to surface water and sediments while wading. Ingestion and dermal contact with contaminated surface water and sediments while wading was assumed to represent complete exposure pathways for both child and adult resident receptors.

Although Soldier Creek does not include any swimming areas per se, several off-Base portions of East Soldier creek are deep enough to swim in, and potentially could be used by children for swimming. Consequently, a child resident swimming scenario was evaluated quantitatively in this RA. A wading scenario for adults was assumed. Exposure was assumed via ingestion and direct dermal contact with surface water and sediment for both children and adults.

Inhalation exposure was assumed to be minor or incomplete for all scenarios and was not evaluated in this RA because both East and West Soldier Creeks are located in open, unconfined areas where atmospheric dilution would quickly attenuate the concentrations of volatilized compounds released from the creek.

Potential exposure to contaminants in the surface water and sediments via ingestion of fish or game animals is not likely to be a significant pathway. Neither East or West Soldier Creeks contain a viable game and fish population, and the location of Tinker AFB within the metropolitan area of Oklahoma City precludes any hunting activities. For these reasons, exposure to contaminants via the food chain was considered an incomplete (or minor) exposure pathway and was not evaluated in this RA.

3.3 RECEPTOR POPULATIONS NOT INCLUDED IN THE RISK ASSESSMENT

Certain potential receptor populations can be excluded from consideration in the RA if they do not represent realistic exposure scenarios. Although sensitive populations (e.g., pregnant

women, the elderly or infirm in hospitals or elderly care facilities, etc.) are likely to be located within the greater metropolitan area of Oklahoma City, they were excluded from the quantitative evaluation because these populations are not likely to be exposed to the media of concern (surface water and sediment).

3.4 EVALUATION OF POTENTIAL EXPOSURE PARAMETERS

To calculate the chronic daily intake (CDI) of COCs and to estimate the associated potential health risks, a number of exposure parameters must first be quantified. Parameters which are typically quantified include the following:

- Life span (days)
- Exposure duration (years)
- Exposure frequency (days/year)
- Exposure time (hours/day)
- Soil/sediment ingestion rate (mg/day)
- Body weight (kg)
- Exposed skin surface area (cm^2)
- Dermal soil adherence (mg/cm^2)
- Dermal soil absorption factor (unitless)
- Water ingestion rate (L/hour)
- Permeability constant (cm/hour)

The exposure parameter assumptions used in this RA were the same as those used in the previous RAs performed by WCFS (1996, 1997b). Consequently, direct comparison of potential risks between the three RAs was possible.

The numerical values for these parameters (**Tables 3-1, 3-2, 3-3** and **3-4)** are used to estimate the extent of chemical exposure. The numerical values were developed using site-specific information supplemented by a number of USEPA reference sources. USEPA guidance used

when developing exposure assumptions include the Exposure Factors Handbook (USEPA 1989b), Standard Default Exposure Factors (USEPA 1991a), Dermal Exposure Assessment: Principles and Applications (USEPA 1992a), USEPA Region IV Guidance (1992b) and RAGS (USEPA 1989a). These exposure assumptions are conservative. As a result, potential exposures and potential health risks are not likely to be underestimated.

The basis for the selection of the number values for the exposure parameters are discussed in the following sections.

3.4.1.1 Life Span

As recommended in the RAGS, life span is assumed to be the same for all receptor populations, and is given as 70 years (1989a).

3.4.1.2 Exposure Duration

Exposure duration refers to the number of years in which exposure occurs. On-Base construction workers are assumed to be full-time employees of Tinker AFB and are assumed to have a RME duration of 25 years, as given by the USEPA (1991a). The average exposure duration of 5 years for an on-Base construction worker is based on the average time an individual spends at one job. This information is supplied by the Bureau of Labor Statistics (U.S. Department of Labor 1987). Residents are assumed to have a reasonable maximum exposure duration of 30 years (5 years between ages 1-6, and 25 years afterward), based on the upper 90th percentile value for time spent in a single residence. The exposure duration for average exposure for an adult resident is assumed to be 9 years based on the mean time spent at a single residence (EPA 1989b). For child residents, the entire 5-year age span (ages 1-6) is conservatively assumed for average exposure.

3.4.1.3 Exposure Frequency

Exposure frequency refers to the number of days per year spent in direct contact with the creek. For RME and average exposure, on-Base construction workers are assumed to spend 5 days and 1 day per year, respectively, working in the vicinity of the creeks. For adult

residents, 1 day per month during the summer months (4 days/year) is assumed for RME. One half of the RME exposure frequency (2 days/year) is assumed for average exposure. For children (ages 1-6), 2 days per week during the 17 summer weeks (34 days/year) is assumed for the RME exposure frequency. One half of the RME exposure frequency (17 days/year) is assumed for average exposure.

3.4.1.4 Exposure Time

Exposure time refers to the number of hours per day that a receptor is in contact with a potentially contaminated medium. For on-Base construction workers, this is assumed to be 8 hours per day, reflecting a normal working day. For average exposure, one half of the time is assumed (4 hours/day) as the fraction of the working day the worker would be in direct contact with surface water or sediment. For adult residents, 2 and 1 hours per day exposure time were assumed for RME and average exposure, respectively. For children, exposure times of 6 and 3 hours per day were assumed for RME and average exposure, respectively.

3.4.1.5 Sediment Ingestion Rate

The sediment ingestion rate refers to the amount of sediment that is ingested daily. Upper-bound ingestion rates provided by USEPA (1991a) were used to evaluate RME exposure. The RME ingestion rates used in this RA were 50 mg/day for workers, 100 mg/day for adult residents, and 200 mg/day for children. For average exposure, ingestion rates of 10 mg/day were assumed for both workers and adult residents, based on information presented in the Exposure Factors Handbook (USEPA 1989b). An average ingestion rate of 100 mg/day was assumed for children, based on one-half the RME value.

3.4.1.6 Body Weight

Body weights were obtained from the Exposure Factors Handbook (USEPA 1989b). An adult body weight of 70 kg was used to evaluate construction workers. Age-weighted average body weights were calculated at 57.1 kg and 15.1 kg, respectively, for adult and child residents.

3.4.1.7 Skin Surface Area

Exposed skin surface area is important when evaluating uptake of chemicals that are absorbed dermally. For dermal exposure to surface water and sediment in West and East Soldier Creeks, an RME surface area of 9,800 cm^2 was estimated for an on-Base construction worker, based on the adult surface areas of the head, hands, arms and lower legs (Exposure Factors Handbook; USEPA 1989b). For average exposure, an exposed area of 2,000 cm^2 was assumed for the construction worker based on the surface area of hands and forearms. Whole body immersion (6,500 cm^2) was assumed for children swimming in the creek, both for RME and average exposure scenarios, as well as for the RME child wading scenario. The average exposed surface area for a wading child was assumed to 1,800 cm^2 based on the surface area for hands, forearms and feet. For adult residents, an RME surface area of 8,620 cm^2 was assumed, based on exposure of the head, hands, forearms, and lower legs. For average exposure, an exposed surface area of 2,800 cm^2 was assumed based on exposure of the hands, forearms and feet.

3.4.1.8 Dermal Sediment Adherence

Dermal sediment adherence is used, in conjunction with exposed skin surface area, to define the total amount of sediment adhering to exposed skin surfaces. The USEPA recommends 1.0 mg/cm^2 and 0.2 mg/cm^2 for upperbound (RME) exposure and average exposure, respectively (Dermal Exposure Assessment: Principles and Applications; USEPA 1992a).

3.4.1.9 Dermal Absorption Factor

The dermal sediment absorption factor provides an estimate of potential chemical absorption through the skin. As presented in USEPA Region IV guidance (1991d), dermal absorption is assumed to be 1.0 percent for organic chemicals and 0.1 percent for inorganic chemicals.

3.4.1.10 Surface Water Ingestion Rate

An RME surface water ingestion rate of 0.05 L hour was assumed for children swimming in East Soldier Creek, based on data presented in the RAGS (USEPA 1989a). For average

exposure while swimming, an ingestion rate of 0.025 L/hour was assumed, based on one-half the RME value.

Surface water ingestion while wading is assumed to be significantly less than while swimming. For all wading scenarios, the RME surface water ingestion rate was assumed to be 0.005 L/hour and the average surface water ingestion rate was assumed to 0.0025 L/hour, based on the assumption that ingestion during wading is 10 percent of the ingestion rate during swimming.

3.4.1.11 Permeability Constant

Permeability constants are chemical-specific values used to define the dermal uptake of chemicals from aqueous media, and are presented in units of cm/hour. Permeability constants used in this RA are derived from Dermal Exposure Assessment: Principles and Applications (USEPA 1992a).

3.5 ESTIMATION OF EXPOSURE POINT CONCENTRATION

Exposure point concentrations are chemical concentrations to which a receptor is exposed when contact is made with a specific environmental medium. The RME and average exposure point concentrations for the COCs are presented in **Tables 3-5 to 3-14**.

When calculating exposure point concentrations for the COCs, chemicals were assumed to be present at one-half the detection limit for any samples in which they were reported as undetected, in accordance with the RAGS (1989a). Using the approach recommended by USEPA (USEPA 1992c), exposure point concentrations for both surface water and sediments were calculated as the upper 95 percent confidence limit values (UCL) of the arithmetic mean concentration assuming lognormal distribution.

$$UCL = e^{(m + 0.5S2 + SH/\sqrt{n-1})}$$

Where:

UCL = Upper 95 percent confidence level

e = Constant (Base of natural log, equal to 2.718)

m = mean of transformed data

S = Standard Deviation of the transformed data

n = number of samples

H = H-statistics (from table published in Gilbert 1987)

The concentration associated with the 95 percent UCL or the maximum concentration detected, whichever was lower, was adopted as the RME exposure point concentration. Use of the maximum concentration, if less than the 95 percent UCL, is recommended by RAGS (USEPA 1989a). This approach is supported by the observation that the 95 percent UCL concentration may exceed the maximum detected concentration in instances where the variation of the data is large or when high detection limits strongly influence calculation of 95 percent UCL values. The concentration associated with the RME exposure point concentration or the mean concentration, whichever was lower, was adopted as the average exposure point concentration.

Exposure point concentrations calculated for surface water (presented in **Tables 3-5, 3-6, 3-7**, and **3-8**) are used to calculate risks associated with both current and future use scenarios. Sediment samples collected from 0 to 0.5 feet are considered to be associated with current use scenarios. Sediment samples collected from all depths are considered to be associated with future use scenarios.

- **Table 3-9** presents the current on-Base West Soldier Creek sediment exposure point concentrations.

- **Table 3-10** presents the future on-Base West Soldier Creek sediment exposure point concentrations.

- **Table 3-11** presents both the current and future off-Base West Soldier Creek sediment exposure point concentrations.

- **Table 3-12** presents the on-Base current sediment exposure point concentrations.

- **Table 3-13** presents the on-Base East Soldier Creek future sediment exposure point concentrations.

- **Table 3-14** presents the off-Base East Soldier Creek current and future sediment exposure point concentrations.

3.6 CALCULATION OF DAILY CHEMICAL INTAKES

Chronic daily intakes (CDIs) represent the daily amount of chemical taken in by a receptor per kilogram body weight, and are used with the Critical Toxicity Values (CTVs) to estimate hazard quotients and potential cancer risks for each chemical (see detailed discussion in **Section 4.0**). The CDIs are calculated for individual chemicals and receptors, based on the potential exposure parameters discussed in **Section 3.4**, using the following equations:

Surface water ingestion for on-Base worker scenario:

$$CDI = (CW \times IR \times ET \times EF \times ED)/(BW \times AT1 \times AT2)$$

Surface water dermal exposure for on-Base worker scenario:

$$CDI = (CW \times SA \times PC \times ET \times EF \times ED \times CF)/(BW \times AT1 \times AT2)$$

Sediment ingestion for on-Base worker scenario:

$$CDI = (CS \times CF \times IR \times EF \times ED)/(BW \times AT1 \times AT2)$$

Sediment dermal exposure for on-Base worker scenario:

$$CDI = (CS \times CF \times SA \times AF \times ABS \times EF \times ED)/(BW \times AT1 \times AT2)$$

Surface water ingestion for off-Base residential scenario:

$$CDI = CW \times HIF \quad and$$

$$HIF = [(IRc \times ETc \times EFc \times EDc) / BWc + (IRa \times ETa \times EFa \times EDa) / BWa] / (AT1 \times AT2)$$

Surface water dermal exposure for off-Base residential scenario:

$$CDI = CW \times HIF \quad and$$

$$HIF = \{[(SAc \times PC \times ETc \times EFc \times EDc) / BWc + (SAa \times PC \times ETa \times EFa \times EDa)/BWa]/(AT1 \times AT2)\} \times CF$$

Sediment ingestion for off-Base residential scenario:

$$CDI = CW \times HIF \quad and$$

$$HIF = \{[(IRc \times EFc \times EDc) / BWc + (IRa \times EFa \times EDa) / BWa] \times CF\}/ (AT1 \times AT2)$$

Sediment dermal exposure for off-Base residential scenario:

$$CDI = CS \times AF \times HIF \quad and$$

$$HIF = \{[(SAc \times EFc \times EDc \times ABS) / BWc + (SAa \times EFa \times EDa \times ABS) / BWa] \times CF\} / (AT1 \times AT2)$$

Where:

CDI = Chronic Daily Intake (mg/kg-day)
HIF = Human Intake Factor (L/kg-day for surface water, mg/kg-day for sediments)
CW = Concentration in Surface Water (mg/L)
CS = Concentration in Sediments (mg/kg)
IR = Ingestion Rate (L/hour for surface water, mg/day for sediments)
IRc = Child Resident Ingestion Rate (L/hour for surface water, mg/day for sediments)
IRa = Adult Resident Ingestion Rate (L/hour for surface water, mg/day for sediments)
ET = Worker Exposure Time (hours)
ETc = Child Resident Exposure Time (hours)
ETa = Adult Resident Exposure Time (hours)
SA = Worker Skin Surface Area available for contact (cm^2)
SAc = Child Resident Skin Surface Area available for contact (cm^2)
SAa = Adult Resident Skin Surface Area available for contact (cm^2)
EF = Worker Exposure Frequency (days/year)
EFc = Child Resident Exposure Frequency (days/year)

PC = Dermal Permeability Constant (cm/hr)

EFa = Adult Resident Exposure Frequency (days/year)

ED = Worker Exposure Duration (years)

EDc = Child Resident Exposure Duration (years)

EDa = Adult Resident Exposure Duration (years)

BW = Worker Body Weight (kg)

BWc = Child Body Weight (kg)

BWa = Adult Body Weight (kg)

AF = Adherence Factor (mg/cm^2)

ABS = Absorption Factor (unitless)

$AT1$ = Days Per Year = 365 days/year

$AT2$ = Averaging Time (70 years for carcinogenic effects, exposure duration for noncarcinogenic effects)

CF = Conversion Factor (kg/mg)

Attachment A presents the CDI calculations associated with each medium, route of exposure, and receptor.

TABLE 3-1

EXPOSURE PARAMETERS
DERMAL CONTACT WITH SEDIMENTS

Exposure Parameter	ADULT RESIDENT		CHILD RESIDENT		CONSTRUCTION WORKER	
	RME [a]	AVERAGE	RME [a]	AVERAGE	RME [a]	AVERAGE
(SA) Exposed Surface Area - wading (cm^2)	8,620 [b,n]	2,800 [b,n]	6,500 [c,n]	1,800 [c,n]	9,800 [b]	2,000 [e]
(SA) Exposed Surface Area - swimming (cm^2)	na	na	6,500 [d,n]	6,500 [d,n]	na	na
(AF) Dermal Sediment Adherence (mg/cm^2)	1.00 [f]	0.20 [f]	1.00 [f]	0.20 [f]	1.00 [f]	0.20 [f]
(ABS) Absorption Factor (unitless)	Chemical Specific [g]					
(ED) Exposure Duration (years)	25 [h]	9 [i]	5 [h]	5 [r]	25 [j]	5 [j]
(EF) Exposure Frequency (days/year)	4 [k]	2 [o]	34 [l]	17 [o]	5 [m]	1 [m]
(BW) Body Weight (kg)	57.1 [n]	57.1 [n]	15.1 [n]	15.1 [n]	70	70
(AT1) Averaging Time - Noncarcinogenic Effects (years)[p]	25	9	5	5	25	5
(AT2) Averaging Time - Cancer Effects (years)[q]	70	70	70	70	70	70

Note:

a. Reasonable Maximum Exposure (RME) is defined by EPA as the reasonable upperbound exposure among potentially exposed populations.

b. The surface area of head, hands, arms, and lower legs is assumed for RME. The surface area of hands, forearms and feet is assumed for average exposure.

c. Exposed surface area is based on whole body for RME. For average exposure, surface area of hands, forearms, and feet are used.

d. Exposed surface area is based on whole body for both RME and average exposure.

e. Average exposed surface for construction worker based on hands and forearms.

f. Dermal adherence based on Dermal Exposure Assessment: Principles and Applications (USEPA, 1992a)

g. Based on the EPA Region IV Guidance (USEPA 1992b) 1.0% dermal absorption is assumed for organics and 0.1% for inorganics.

h. Residents are assumed to have a RME duration of 30 years (5 years between age 1-6, 25 years as adult), based on the upper 90th percentile value for time spent in a single residence (Exposure Factors Handbook, USEPA,1989b).

i. Average duration at a single residence is 9 years, as identified in Exposure Factors Handbook (USEPA, 1989b).

j. Construction workers are assumed to have an RME duration of 25 years as given in OSWER Directive 9285.6-03 (USEPA, 1991a). For average exposure, the exposure duration of 5 years is based on the average time spent at a job (U.S. Department of Labor, 1987).

k. Assumes 1 day/month exposure during the 4 months of summer.

l. Assumes 2 day/week exposure for the 17 weeks of summer.

m. Exposure frequency for construction workers assumes minor construction activities in the creek.

n. Age-weighted average.

o. Assumed value based on one-half the RME value.

p. Averaging time for noncarcinogenic effects is based on the exposure duration.

q. Averaging time for carcinogenic effects is based on assumed lifetime of 70 years.

r. Average exposure duration for a child assumes entire 5 year age span (age 1-6).

na. Not applicable.

TABLE 3-2

EXPOSURE PARAMETERS
INGESTION OF SEDIMENTS

Exposure Parameter	ADULT RESIDENT		CHILD RESIDENT		CONSTRUCTION WORKER	
	RME [a]	AVERAGE	RME [a]	AVERAGE	RME [a]	AVERAGE
(IR) Ingestion Rate (mg/day)	100 [b]	10 [c]	200 [b]	100 [k]	50 [b]	10 [c]
(ED) Exposure Duration (years)	25 [d]	9 [e]	5 [d]	5 [n]	25 [f]	5 [f]
(EF) Exposure Frequency (days/year)	4 [g]	2 [k]	34 [h]	17 [k]	5 [i]	1 [i]
(BW) Body Weight (kg)	57.1 [j]	57.1 [j]	15.1 [j]	15.1 [j]	70	70
(AT1) Averaging Time - Noncarcinogenic Effects (years)[l]	25	9	5	5	25	5
(AT2) Averaging Time - Cancer Effects (years)[m]	70	70	70	70	70	70

Note:

a. Reasonable Maximum Exposure (RME) is defined by EPA as the reasonable upperbound exposure among potentially exposed populations.

b. For RME, standard default sediment ingestion rates of 100 mg/day for adult resident, 200mg/day for children and 50 mg/day for workers were assumed (USEPA, 1991b).

c. Average ingestion rate as identified in Exposure Factors Handbook (USEPA, 1989b).

d. Residents are assumed to have a RME duration of 30 years (5 years between age 1-6, 25 years as adult), based on the upper 90th percentile value for time spent in a single residence (Exposure Factors Handbook, USEPA,1989b).

e. Average duration at a single residence is 9 years, as identified in Exposure Factors Handbook (USEPA, 1989b).

f. Construction workers are assumed to have an RME duration of 25 years as given in OSWER Directive 9285.6-03 (USEPA, 1991a). For average exposure, the exposure duration of 5 years is based on the average time spent at a job (U.S. Department of Labor, 1987).

g. Assumes 1 day/month exposure during the 4 months of summer.

h. Assumes 2 day/week for the 17 weeks of summer.

i. Exposure frequency for construction workers assumes minor construction activities in the creek.

j. Age-weighted average.

k. Assumed value based on one-half the RME value.

l. Averaging time for noncarcinogenic effects is based on the exposure duration.

m. Averaging time for carcinogenic effects is based on assumed lifetime of 70 years.

n. Average exposure duration for a child assumes entire 5-year age span (age 1-6).

TABLE 3-3

EXPOSURE PARAMETERS
DERMAL CONTACT WITH SURFACE WATER

Exposure Parameter	ADULT RESIDENT		CHILD RESIDENT		CONSTRUCTION WORKER	
	RME [a]	AVERAGE	RME [a]	AVERAGE	RME [a]	AVERAGE
(SA) Exposed Surface Area - wading (cm^2)	8,620 [c,m]	2,800 [e,m]	6,500 [d,m]	1,800 [e,m]	9,800 [c]	2,000 [f]
(SA) Exposed Surface Area - swimming (cm^2) [b]	na	na	6,500 [d,m]	6,500 [d,m]	na	na
(PC) Dermal Permeability Constant (cm/hour)	Chemical-Specific					
(ET) Exposure Time (hours/day)	2	1 [o]	6	3 [o]	8	4 [o]
(ED) Exposure Duration (years)	25 [g]	9 [h]	5 [g]	5 [r]	25 [i]	5 [i]
(EF) Exposure Frequency (days/year)	4 [j]	2 [o]	34 [k]	17 [o]	5 [l]	1 [l]
(BW) Body Weight (kg)	57.1 [m]	57.1 [m]	15.1 [m]	15.1 [m]	70	70
(AT1) Averaging Time - Noncarcinogenic Effects (years) [p]	25	9	5	5	25	5
(AT2) Averaging Time - Cancer Effects (years) [q]	70	70	70	70	70	70

Note:

a. Reasonable Maximum Exposure (RME) is defined by EPA as the reasonable upperbound exposure among potentially exposed populations.

b. Swimming is only evaluated for the child scenario in off-base portions of East Soldier Creek.

c. The surface area of head, hands, arms, and lower legs is assumed for RME.

d. Exposed surface area is based on whole body exposure.

e. Average exposure assumes surface area of hands, forearms, and feet.

f. Average exposed surface area for construction workers based on hands and forearms.

g. Residents are assumed to have a RME duration of 30 years (5 years between age 1-6, 25 years as adult), based on the upper 90th percentile value for time spent in a single residence (Exposure Factors Handbook, USEPA,1989b).

h. Average duration at a single residence is 9 years, as identified in Exposure Factors Handbook (USEPA, 1989b).

i. Construction workers are assumed to have an RME duration of 25 years as given in OSWER Directive 9285.6-03 (USEPA, 1991a). For average exposure, the exposure duration of 5 years is based on the average time spent at a job (U.S. Department of Labor, 1987).

j. Assumes 1 day/month exposure during the 4 months of summer.

k. Assumes 2 day/week exposure for the 17 weeks of summer.

l. Exposure frequency for construction workers assumes minor construction activities in the creek.

m. Age-weighted average.

o. Assumed value based on one-half the RME value.

p. Averaging time for noncarcinogenic effects is based on the exposure duration.

q. Averaging time for carcinogenic effects is based on lifetime of 70 years.

r. Average exposure duration for a child assumes entire 5-year age span (age 1-6).

na. Not applicable.

TABLE 3-4

EXPOSURE PARAMETERS
INGESTION OF SURFACE WATER

Parameter	ADULT RESIDENT		CHILD RESIDENT		CONSTRUCTION WORKER	
	RME [a]	AVERAGE	RME [a]	AVERAGE	RME [a]	AVERAGE
(IR) Ingestion Rate - wading (L/hour)	0.005 [c]	0.0025 [l]	0.005 [c]	0.0025 [l]	0.005 [c]	0.0025 [l]
(IR) Ingestion Rate - Swimming (L/hour) [b]	na	na	0.050 [d]	0.025 [l]	na	na
(ET) Exposure Time (hours/day)	2	1 [l]	6	3 [l]	8	4 [l]
(ED) Exposure Duration (years)	25 [e]	9 [f]	5 [e]	5 [o]	25 [g]	5 [g]
(EF) Exposure Frequency (days/year)	4 [h]	2 [i]	34 [i]	17 [i]	5 [j]	1 [j]
(BW) Body Weight (kg)	57.1 [k]	57.1 [k]	15.1 [k]	15.1 [k]	70	70
(AT1) Averaging Time - Noncarcinogenic Effects (years) [m]	25	9	5	5	25	5
(AT2) Averaging Time - Cancer Effects (years) [n]	70	70	70	70	70	70

Note:

a Reasonable Maximum Exposure (RME) is defined by EPA as the reasonable upperbound exposure among potentially exposed populations.

b Swimming is only evaluated for the child scenario in off-base portions of East Soldier Creek.

c Assumed to be one-tenth of the surface water ingestion rate while swimming.

d Surface water ingestion rate while swimming as identified in RAGS (USEPA, 1989a).

e Residents are assumed to have a RME duration of 30 years (5 years between age 1-6, 25 years as adult), based on the upper 90th percentile value for time spent in a single residence (Exposure Factors Handbook, USEPA,1989b).

f Average duration at a single residence is 9 years, as identified in Exposure Factors Handbook (USEPA, 1989b).

g Construction workers are assumed to have an RME duration of 25 years as given in OSWER Directive 9285.6-03 (USEPA, 1991a). For average exposure, the exposure duration of 5 years is based on the average time spent at a job (U.S. Department of Labor, 1987).

h Assumes 1 day/month exposure during the 4 months of summer.

i Assumes 2 day/week exposure for the 17 weeks of summer.

j Exposure frequency for construction workers assumes minor construction activities in the creek.

k Age-weighted average.

l Assumed value based on one-half the RME value.

m Averaging time for noncarcinogenic effects is based on the exposure duration.

n Averaging time for carcinogenic effects is based on lifetime of 70 years.

o Average exposure duration for a child assumes entire 5-year age span (age 1-6).

na. Not applicable.

TABLE 3-5

EXPOSURE POINT CONCENTRATIONS
ON-BASE WEST SOLDIER CREEK SURFACE WATER
(CURRENT AND FUTURE SCENARIOS)

Chemical	Maximum Detected Concentration (mg/L)	Mean[a] (mg/L)	UCL[a,b] (mg/L)	RME Exposure Point Concentration[c] (mg/L)	Average Exposure Point Concentration[d] (mg/L)
Metals					
Antimony	5.50E-04	3.90E-04	2.50E-01	5.50E-04	3.90E-04
Arsenic	3.80E-03	4.60E-03	6.70E-03	3.80E-03	3.80E-03
Cadmium	8.80E-04	3.70E-04	5.20E+03	8.80E-04	3.70E-04
Cobalt	1.80E-03	9.90E-04	2.10E+03	1.80E-03	9.90E-04
Nickel	5.20E-02	2.20E-02	1.50E+04	5.20E-02	2.20E-02
Vanadium	4.90E-03	2.20E-03	2.30E+01	4.90E-03	2.20E-03
Semivolatile Organics					
bis(2-Ethylhexyl)phthalate	4.30E-03	4.80E-03	5.70E-03	4.30E-03	4.30E-03
Volatile Organics					
Acetone	3.70E-03	4.60E-03	6.90E-03	3.70E-03	3.70E-03
Chloromethane	1.10E-03	3.70E-03	6.30E+00	1.10E-03	1.10E-03
Styrene	3.40E-03	2.80E-03	4.30E-03	3.40E-03	2.80E-03

Notes:

a. One half the detection limit is used for all nondetects when calculating values.

b. The upper 95 percent confidence limit values (UCL) of the arithmetic mean concentration assuming lognormal distribution.

c. The concentration associated with the 95 percent UCL or the maximum concentration detected, whichever was lower, was used as the RME exposure point concentration.

d. The RME exposure point concentration or the mean concentration, whichever was lower, was adopted as the average exposure point concentration.

TABLE 3-6

EXPOSURE POINT CONCENTRATIONS
OFF-BASE WEST SOLDIER CREEK SURFACE WATER
(CURRENT AND FUTURE SCENARIO)

Chemical	Maximum Detected Concentration (mg/L)	Mean[a] (mg/L)	UCL[a,b] (mg/L)	RME Exposure Point Concentration[c] (mg/L)	Average Exposure Point Concentration[d] (mg/L)
Metals					
Antimony	4.40E-04	4.30E-04	6.80E-04	4.40E-04	4.30E-04
Cadmium	5.20E-04	4.00E-04	9.80E-04	5.20E-04	4.00E-04
Cobalt	3.60E-04	2.30E-04	1.20E-01	3.6 E-04	2.30E-04
Nickel	1.60E-02	8.60E-03	5.70E+04	1.60E-02	8.60E-03
Vanadium	1.60E-02	7.50E-03	8.60E-02	1.60E-02	7.50E-03
Volatile Organics					
Acetone	5.50E-03	5.10E-03	5.40E-03	5.40E-03	5.10E-03
Bromomethane	7.20E-03	5.60E-03	7.20E-03	7.20E-03	5.60E-03
Chloromethane	3.60E-03	3.90E-03	9.10E-03	3.60E-03	3.60E-03
Iodomethane	1.80E-03	2.00E-03	3.70E-03	1.80E-03	1.80E-03
Methylene chloride	1.40E-03	2.20E-03	3.60E-03	1.40E-03	1.40E-03

Notes:

a. One half the detection limit is used for all nondetects when calculating values.

b. The upper 95 percent confidence limit values (UCL) of the arithmetic mean concentration assuming lognormal distribution.

c. The concentration associated with the 95 percent UCL or the maximum concentration detected, whichever was lower, was used as the RME exposure point concentration.

d. The RME exposure point concentration or the mean concentration, whichever was lower, was adopted as the average exposure point concentration.

TABLE 3-7

EXPOSURE POINT CONCENTRATIONS
ON-BASE EAST SOLDIER CREEK SURFACE WATER
(CURRENT AND FUTURE SCENARIOS)

Chemical	Maximum Detected Concentration (mg/L)	Mean[a] (mg/L)	UCL[a,b] (mg/L)	RME Exposure Point Concentration[c] (mg/L)	Average Exposure Point Concentration[d] (mg/L)
Metals					
Antimony	2.50E-04	5.50E-04	1.10E-03	2.50E-04	2.50E-04
Arsenic	2.70E-03	2.50E-03	2.50E-03	2.50E-03	2.50E-03
Cadmium	1.60E-02	1.40E-03	3.30E-03	3.30E-03	1.40E-03
Cobalt	9.60E-04	3.40E-04	4.80E-04	4.80E-04	3.40E-04
Nickel	2.00E-02	8.50E-03	1.30E-02	1.30E-02	8.50E-03
Silver	6.20E-04	3.80E-04	4.70E-04	4.70E-04	3.80E-04
Vanadium	1.80E-02	1.30E-02	1.40E-02	1.40E-02	1.30E-02
Pesticides/PCBs					
Aroclor 1254	5.80E-04	4.90E-04	5.00E-04	5.00E-04	4.90E-04
Semivolatile Organics					
bis(2-Ethylhexyl)phthalate	1.20E-02	5.10E-03	5.70E-03	5.70E-03	5.10E-03
Volatile Organics					
Acetone	1.20E-02	5.30E-03	6.10E-03	6.10E-03	5.30E-03
Bromoform	1.60E-03	2.50E-03	2.60E-03	1.60E-03	1.60E-03
Dibromochloromethane	1.80E-03	2.50E-03	2.50E-03	1.80E-03	1.80E-03
Ethanol	4.10E-02	2.40E-01	3.00E-01	4.10E-02	4.10E-02
Methylene chloride	1.30E-03	2.50E-03	3.10E-03	1.30E-03	1.30E-03

Notes:

a. One half the detection limit is used for all nondetects when calculating values.

b. The upper 95 percent confidence limit values (UCL) of the arithmetic mean concentration assuming lognormal distribution.

c. The concentration associated with the 95 percent UCL or the maximum concentration detected, whichever was lower, was used as the RME exposure point concentration.

d. The RME exposure point concentration or the mean concentration, whichever was lower, was adopted as the average exposure point concentration.

TABLE 3-8

EXPOSURE POINT CONCENTRATIONS
OFF-BASE EAST SOLDIER CREEK SURFACE WATER
(CURRENT AND FUTURE SCENARIOS)

Chemical	Maximum Detected Concentration (mg/L)	Mean[a] (mg/L)	UCL[a,b] (mg/L)	RME Exposure Point Concentration[c] (mg/L)	Average Exposure Point Concentration[d] (mg/L)
Metals					
Antimony	2.90E-04	3.80E-04	8.70E-04	2.90E-04	2.90E-04
Arsenic	2.80E-03	2.50E-03	2.80E-03	2.80E-03	2.50E-03
Cadmium	1.30E-03	9.50E-04	4.10E-03	1.30E-03	9.50E-04
Cobalt	4.00E-04	3.60E-04	4.40E-04	4.00E-04	3.60E-04
Nickel	1.20E-02	9.50E-03	6.00E-02	1.20E-02	9.50E-03
Vanadium	1.60E-02	1.20E-02	3.30E-02	1.60E-02	1.20E-02
Semivolatile Organics					
bis(2-Ethylhexyl)phthalate	5.00E-03	4.80E-03	5.40E-03	5.00E-03	4.80E-03
Volatile Organics					
Acetone	4.10E-03	4.80E-03	5.40E-03	4.10E-03	4.10E-03

Notes:

a. One half the detection limit is used for all nondetects when calculating values.

b. The upper 95 percent confidence limit values (UCL) of the arithmetic mean concentration assuming lognormal distribution.

c. The concentration associated with the 95 percent UCL or the maximum concentration detected, whichever was lower, was used as the RME exposure point concentration.

d. The RME exposure point concentration or the mean concentration, whichever was lower, was adopted as the average exposure point concentration.

TABLE 3-9

EXPOSURE POINT CONCENTRATIONS
ON-BASE WEST SOLDIER CREEK SEDIMENT
(CURRENT SCENARIO)

Chemical	Maximum Detected Concentration (mg/kg)	Mean[a,b] (mg/kg)	UCL[a,b,c] (mg/kg)	RME Exposure Point Concentration[d] (mg/kg)	Average Exposure Point Concentration[e] (mg/kg)
Metals					
Beryllium	1.70E+00	8.51E-01	1.20E+00	1.20E+00	8.50E-01
Cadmium	8.00E+01	1.56E+01	8.50E+02	8.00E+01	1.60E+01
Cobalt	6.17E+01	1.89E+01	4.50E+01	4.50E+01	1.90E+01
Lead	2.98E+02	8.33E+01	2.80E+02	2.80E+02	8.30E+01
Mercury	3.80E-01	1.26E-01	7.80E-01	3.80E-01	1.30E-01
Nickel	1.43E+03	3.56E+02	1.20E+04	1.40E+03	3.60E+02
Silver	9.92E+01	2.30E+01	2.50E+03	9.90E+01	2.30E+01
Thallium	1.27E+02	1.12E+02	3.30E+02	1.30E+02	1.10E+02
Vanadium	8.21E+01	3.87E+01	5.60E+01	5.60E+01	3.90E+01
Pesticides/PCBs					
4,4'-DDE	8.50E-03	7.38E-03	2.10E-02	8.50E-03	7.40E-03
Aldrin	6.70E-03	3.74E-03	1.00E-02	6.70E-03	3.70E-03
Aroclor 1254	4.40E+00	6.86E-01	2.10E+01	4.40E+00	6.90E-01
Heptachlor epoxide	2.80E-03	3.65E-03	9.70E-03	2.80E-03	2.80E-03
Semivolatile Organics					
Anthracene	6.10E-02	6.84E-01	2.50E+00	6.10E-02	6.10E-02
Benzo(a)anthracene	1.90E+00	4.61E-01	2.00E+00	1.90E+00	4.60E-01
Benzo(a)pyrene	5.20E+00	8.42E-01	7.70E+00	5.20E+00	8.40E-01
Benzo(b)fluoranthene	4.20E+00	7.78E-01	6.00E+00	4.20E+00	7.80E-01
Benzo(g,h,i)perylene	5.30E+00	7.51E-01	3.70E+00	3.70E+00	7.50E-01
Benzo(k)fluoranthene	4.10E+00	8.20E-01	6.90E+00	4.10E+00	8.20E-01
Chrysene	2.50E+00	5.85E-01	3.10E+00	2.50E+00	5.80E-01
Di-n-butyl phthalate	2.00E-01	6.97E-01	1.90E+00	2.00E-01	2.00E-01
Dibenz(a,h)anthracene	1.60E+00	3.64E-01	6.80E-01	6.80E-01	3.60E-01
Fluoranthene	3.40E+00	8.19E-01	5.00E+00	3.40E+00	8.20E-01

TABLE 3-9

EXPOSURE POINT CONCENTRATIONS
ON-BASE WEST SOLDIER CREEK SEDIMENT
(CURRENT SCENARIO)

Chemical	Maximum Detected Concentration (mg/kg)	Mean[a,b] (mg/kg)	UCL[a,b,c] (mg/kg)	RME Exposure Point Concentration[d] (mg/kg)	Average Exposure Point Concentration[e] (mg/kg)
Indeno(1,2,3-cd)pyrene	4.70E+00	6.98E-01	2.50E+00	2.50E+00	7.00E-01
Phenanthrene	2.30E+00	4.78E-01	2.90E+00	2.30E+00	4.80E-01
Pyrene	2.80E+00	7.01E-01	4.00E+00	2.80E+00	7.00E-01
bis(2-Ethylhexyl)phthalate	1.40E-01	3.93E-01	1.40E+00	1.40E-01	1.40E-01
Volatile Organics					
Acetone	5.90E-02	1.79E-02	4.70E-02	4.70E-02	1.80E-02
Carbon disulfide	5.70E-03	6.58E-03	1.20E-02	5.70E-03	5.70E-03
Chloromethane	4.00E-03	1.15E-02	1.90E-02	4.00E-03	4.00E-03
Ethylbenzene	4.50E-03	6.46E-03	1.10E-02	4.50E-03	4.50E-03
Methylene chloride	1.40E-03	6.49E-03	1.30E-02	1.40E-03	1.40E-03
Styrene	5.00E-01	5.33E-02	2.30E-01	2.30E-01	5.30E-02
Toluene	3.40E-02	9.41E-03	2.50E-02	2.50E-02	9.40E-03
Vinyl chloride	2.80E-03	1.22E-02	2.40E-02	2.80E-03	2.80E-03

Notes:

a Surface (0-0.5 feet) sediment data are used in the calculations.

b One half the detection limit is used for all nondetects when calculating values.

c The upper 95 percent confidence limit values (UCL) of the arithmetic mean concentration assuming lognormal distribution.

d The concentration associated with the 95 percent UCL or the maximum concentration detected, whichever was lower, was used as the RME exposure point concentration.

e The RME exposure point concentration or the mean concentration, whichever was lower, was adopted as the average exposure point concentration.

TABLE 3-10

EXPOSURE POINT CONCENTRATIONS
ON-BASE WEST SOLDIER CREEK SEDIMENTS
(FUTURE SCENARIO)

Chemical	Maximum Detected Concentration (mg/kg)	Mean Concentration[a,b] (mg/kg)	UCL[a,b,c] (mg/kg)	RME Exposure Point Concentration[d] (mg/kg)	Average Exposure Point Concentration[e] (mg/kg)
Metals					
Antimony	1.10E+01	4.50E+00	5.00E+00	5.00E+00	4.50E+00
Beryllium	1.70E+00	7.40E-01	9.40E-01	9.40E-01	7.40E-01
Cadmium	2.10E+02	2.20E+01	1.60E+02	1.60E+02	2.20E+01
Chromium	4.00E+03	3.20E+02	8.00E+02	8.00E+02	3.20E+02
Cobalt	1.70E+02	2.40E+01	3.50E+01	3.50E+01	2.40E+01
Lead	9.30E+02	9.40E+01	1.90E+02	1.90E+02	9.40E+01
Mercury	5.50E-01	1.00E-01	1.80E-01	1.80E-01	1.00E-01
Nickel	6.50E+03	4.40E+02	1.40E+03	1.40E+03	4.40E+02
Silver	7.30E+02	4.00E+01	1.70E+02	1.70E+02	4.00E+01
Thallium	1.30E+02	9.60E+01	1.40E+02	1.30E+02	9.60E+01
Vanadium	1.20E+02	3.80E+01	4.80E+01	4.80E+01	3.80E+01
Pesticides/PCBs					
Aldrin	6.70E-03	2.00E-02	2.80E-02	6.70E-03	6.70E-03
Aroclor 1254	8.20E+01	4.20E+00	3.00E+01	3.00E+01	4.20E+00
Semivolatile Organics					
1,2-Dichlorobenzene	1.60E+00	5.60E-01	7.30E-01	7.30E-01	5.60E-01
2-Methylnaphthalene	8.50E-01	5.00E-01	6.20E-01	6.20E-01	5.00E-01
Acenaphthene	1.10E+00	5.20E-01	7.20E-01	7.20E-01	5.20E-01
Anthracene	1.60E+00	5.40E-01	8.40E-01	8.40E-01	5.40E-01
Benzidine	2.20E-01	8.40E+00	1.50E+01	2.20E-01	2.20E-01
Benzo(a)anthracene	5.70E+00	7.30E-01	1.20E+00	1.20E+00	7.30E-01
Benzo(a)pyrene	5.80E+00	8.70E-01	1.50E+00	1.50E+00	8.70E-01
Benzo(b)fluoranthene	5.60E+00	8.90E-01	1.60E+00	1.60E+00	8.90E-01
Benzo(g,h,i)perylene	5.30E+00	5.80E-01	8.30E-01	8.30E-01	5.80E-01
Benzo(k)fluoranthene	9.50E+00	1.10E+00	1.90E+00	1.90E+00	1.10E+00
Chrysene	7.00E+00	9.00E-01	1.50E+00	1.50E+00	9.00E-01

TABLE 3-10

EXPOSURE POINT CONCENTRATIONS
ON-BASE WEST SOLDIER CREEK SEDIMENTS
(FUTURE SCENARIO)

Chemical	Maximum Detected Concentration (mg/kg)	Mean Concentration[a,b] (mg/kg)	UCL[a,b,c] (mg/kg)	RME Exposure Point Concentration[d] (mg/kg)	Average Exposure Point Concentration[e] (mg/kg)
Dibenz(a,h)anthracene	1.60E+00	3.90E-01	5.10E-01	5.10E-01	3.90E-01
Dibenzofuran	1.10E+00	5.20E-01	6.70E-01	6.70E-01	5.20E-01
Fluoranthene	2.10E+01	1.80E+00	3.00E+00	3.00E+00	1.80E+00
Fluorene	1.40E+00	5.40E-01	7.10E-01	7.10E-01	5.40E-01
Indeno(1,2,3-cd)pyrene	4.70E+00	5.60E-01	7.90E-01	7.90E-01	5.60E-01
Naphthalene	2.10E+00	5.90E-01	7.90E-01	7.90E-01	5.90E-01
Phenanthrene	1.40E+01	1.30E+00	2.10E+00	2.10E+00	1.30E+00
Pyrene	1.20E+01	1.40E+00	2.20E+00	2.20E+00	1.40E+00
bis(2-Ethylhexyl)phthalate	1.40E-01	7.60E-01	1.10E+00	1.40E-01	1.40E-01
Volatile Organics					
Acetone	8.90E-02	1.40E-02	1.80E-02	1.80E-02	1.40E-02
Ethylbenzene	5.30E-02	6.40E-03	7.20E-03	7.20E-03	6.40E-03
Methylene chloride	1.80E-03	4.90E-03	6.10E-03	1.80E-03	1.80E-03
Styrene	5.00E-01	3.40E-02	2.60E-02	2.60E-02	2.60E-02
Toluene	3.40E-02	6.70E-03	8.40E-03	8.40E-03	6.70E-03

Notes:

a Sediment data from all depths are used in the calculations.

b One half the detection limit is used for all nondetects when calculating values.

c The upper 95 percent confidence limit values (UCL) of the arithmetic mean concentration assuming lognormal distribution.

d The concentration associated with the 95 percent UCL or the maximum concentration detected, whichever was lower, was used as the RME exposure point concentration.

e The RME exposure point concentration or the mean concentration, whichever was lower, was adopted as the average exposure point concentration.

TABLE 3-11

EXPOSURE POINT CONCENTRATIONS
OFF-BASE WEST SOLDIER CREEK SEDIMENTS
(CURRENT AND FUTURE SCENARIOS)

Chemical	Maximum Detected Concentration (mg/kg)	Mean[a,b] (mg/kg)	UCL[a,b,c] (mg/kg)	RME Exposure Point Concentration[d] (mg/kg)	Average Exposure Point Concentration[e] (mg/kg)
Metals					
Antimony	4.40E+00	3.90E+00	4.40E+00	4.40E+00	3.90E+00
Beryllium	5.10E-01	2.60E-01	1.70E+00	5.10E-01	2.60E-01
Cadmium	1.70E+01	7.20E+00	1.10E+03	1.70E+01	7.20E+00
Chromium (VI)	8.40E+00	2.30E+00	6.70E+06	8.40E+00	2.30E+00
Cobalt	7.30E+00	6.80E+00	7.60E+00	7.30E+00	6.80E+00
Lead	2.50E+02	7.50E+01	1.00E+06	2.50E+02	7.50E+01
Mercury	5.50E-02	2.70E-02	1.30E-01	5.50E-02	2.70E-02
Silver	1.60E+01	7.30E+00	4.70E+04	1.60E+01	7.30E+00
Vanadium	2.30E+01	1.50E+01	3.10E+01	2.30E+01	1.50E+01
Pesticides/PCBs					
Aroclor 1254	6.00E+00	2.30E+00	4.20E+03	6.00E+00	2.30E+00
Semivolatile Organics					
2-Methylnaphthalene	2.80E-01	2.20E-01	2.80E-01	2.80E-01	2.20E-01
Acenaphthene	2.00E+00	6.50E-01	1.80E+02	2.00E+00	6.50E-01
Anthracene	3.20E+00	9.50E-01	3.10E+03	3.20E+00	9.50E-01
Benzo(a)anthracene	9.90E+00	2.60E+00	6.20E+08	9.90E+00	2.60E+00
Benzo(a)pyrene	7.90E+00	2.10E+00	2.20E+08	7.90E+00	2.10E+00
Benzo(b)fluoranthene	9.40E+00	2.40E+00	6.60E+08	9.40E+00	2.40E+00
Benzo(g,h,i)perylene	3.90E+00	1.00E+00	9.40E+07	3.90E+00	1.00E+00
Benzo(k)fluoranthene	8.30E+00	2.20E+00	1.10E+08	8.30E+00	2.20E+00
Butyl benzyl phthalate	4.70E-01	2.70E-01	6.40E-01	4.70E-01	2.70E-01
Chrysene	1.20E+01	3.10E+00	7.70E+08	1.20E+01	3.10E+00

TABLE 3-11

EXPOSURE POINT CONCENTRATIONS
OFF-BASE WEST SOLDIER CREEK SEDIMENTS
(CURRENT AND FUTURE SCENARIOS)

Chemical	Maximum Detected Concentration (mg/kg)	Mean[a,b] (mg/kg)	UCL[a,b,c] (mg/kg)	RME Exposure Point Concentration[d] (mg/kg)	Average Exposure Point Concentration[e] (mg/kg)
Di-n-octyl phthalate	6.60E-01	3.10E-01	1.50E+00	6.60E-01	3.10E-01
Dibenz(a,h)anthracene	3.60E-01	2.40E-01	4.00E-01	3.60E-01	2.40E-01
Dibenzofuran	1.20E+00	4.50E-01	1.20E+01	1.20E+00	4.50E-01
Fluoranthene	2.70E+01	6.90E+00	2.00E+13	2.70E+01	6.90E+00
Fluorene	2.20E+00	7.00E-01	2.50E+02	2.20E+00	7.00E-01
Indeno(1,2,3-cd)pyrene	4.30E+00	1.10E+00	2.10E+08	4.30E+00	1.10E+00
Naphthalene	6.90E-01	3.20E-01	1.70E+00	6.90E-01	3.20E-01
Phenanthrene	2.10E+01	5.40E+00	1.90E+11	2.10E+01	5.40E+00
Pyrene	2.50E+01	6.40E+00	3.10E+13	2.50E+01	6.40E+00
bis(2-Ethylhexyl)phthalate	1.30E-01	2.80E-01	8.70E+00	1.30E-01	1.30E-01
Volatile Organics					
Acetone	5.60E-03	5.90E-03	6.20E-03	5.60E-03	5.60E-03
Methylene chloride	1.80E-03	3.40E-03	1.00E-02	1.80E-03	1.80E-03

Notes:

a. Sediment data from all depths are used in the calculations.

b. One half the detection limit is used for all nondetects when calculating values.

c. The upper 95 percent confidence limit values (UCL) of the arithmetic mean concentration assuming lognormal distribution.

d. The concentration associated with the 95 percent UCL or the maximum concentration detected, whichever was lower, was used as the RME exposure point concentration.

e. The RME exposure point concentration or the mean concentration, whichever was lower, was adopted as the average exposure point concentration.

TABLE 3-12

EXPOSURE POINT CONCENTRATIONS
ON-BASE EAST SOLDIER CREEK SEDIMENTS
(CURRENT SCENARIO)

Chemical	Maximum Detected Concentration (mg/kg)	Mean[a,b] (mg/kg)	UCL[a,b,c] (mg/kg)	RME Exposure Point Concentration[d] (mg/kg)	Average Exposure Point Concentration[e] (mg/kg)
Metals					
Antimony	7.60E+00	4.90E+00	5.60E+00	5.60E+00	4.90E+00
Beryllium	8.20E-01	4.90E-01	7.40E-01	7.40E-01	4.90E-01
Cadmium	8.37E+02	6.20E+01	2.00E+03	8.40E+02	6.20E+01
Chromium	2.80E+03	4.90E+02	1.80E+03	1.80E+03	4.90E+02
Cobalt	5.04E+01	1.50E+01	2.20E+01	2.20E+01	1.50E+01
Lead	5.28E+02	1.70E+02	6.30E+02	5.30E+02	1.70E+02
Mercury	8.30E+00	1.10E+00	3.50E+00	3.50E+00	1.10E+00
Silver	1.52E+01	4.70E+00	1.30E+01	1.30E+01	4.70E+00
Thallium	7.26E+01	1.40E+02	2.30E+02	7.30E+01	7.30E+01
Vanadium	8.29E+01	2.90E+01	3.70E+01	3.70E+01	2.90E+01
Pesticides/PCBs					
4,4'-DDD	4.20E-02	6.10E-02	3.70E-01	4.20E-02	4.20E-02
Aldrin	9.70E-02	3.50E-02	2.50E-01	9.70E-02	3.50E-02
Aroclor 1254	1.00E+01	1.50E+00	1.20E+01	1.00E+01	1.50E+00
Aroclor 1260	6.80E-02	6.30E-01	4.10E+00	6.80E-01	6.30E-01
Endosulfan II	9.30E-02	6.50E-02	4.50E-01	9.30E-02	6.50E-02
alpha-Chlordane	1.30E-02	3.10E-02	1.90E-01	1.30E-02	1.30E-02
gamma-Chlordane	2.30E-02	3.20E-02	2.00E-01	2.30E-02	2.30E-02
Semivolatile Organics					
1,2-Dichlorobenzene	2.20E-01	7.90E-01	1.50E+00	2.20E-01	2.20E-01
1,4-Dichlorobenzene	1.30E-01	8.10E-01	2.00E+00	1.30E-01	1.30E-01
1-Chloronaphthalene	1.60E-01	4.80E+00	1.40E+01	1.60E-01	1.60E-01
2,4-Dimethylphenol	6.40E-02	8.10E-01	1.90E+00	6.40E-02	6.40E-02
2-Chloronaphthalene	5.00E-01	8.30E-01	1.50E+00	5.00E-01	5.00E-01
2-Methylnaphthalene	4.70E-01	7.20E-01	2.40E+00	4.70E-01	4.70E-01
3-Methylcholanthrene	2.50E-02	1.60E+00	3.20E+00	2.50E-01	2.50E-01
Acenaphthene	2.20E+00	8.10E-01	1.80E+00	1.80E+00	8.10E-01

TABLE 3-12

EXPOSURE POINT CONCENTRATIONS
ON-BASE EAST SOLDIER CREEK SEDIMENTS
(CURRENT SCENARIO)

Chemical	Maximum Detected Concentration (mg/kg)	Mean[a,b] (mg/kg)	UCL[a,b,c] (mg/kg)	RME Exposure Point Concentration[d] (mg/kg)	Average Exposure Point Concentration[e] (mg/kg)
Acetophenone	1.10E-01	8.00E-01	1.70E+00	1.10E-01	1.10E-01
Anthracene	4.40E+00	1.20E+00	4.00E+00	4.00E+00	1.20E+00
Benzo(a)anthracene	9.10E+00	2.90E+00	1.30E+01	9.10E+00	2.90E+00
Benzo(a)pyrene	1.10E+01	3.20E+00	1.30E+01	1.10E+01	3.20E+00
Benzo(b)fluoranthene	1.30E+01	3.80E+00	1.90E+01	1.30E+01	3.80E+00
Benzo(g,h,i)perylene	4.50E+00	1.60E+00	5.30E+00	4.50E+00	1.60E+00
Benzo(k)fluoranthene	1.20E+01	3.00E+00	1.20E+01	1.20E+01	3.00E+00
Benzoic acid	2.80E-01	3.80E+00	8.70E+00	2.80E-01	2.80E-01
Butyl benzyl phthalate	5.10E-01	8.10E-01	1.50E+00	5.10E-01	5.10E-01
Chrysene	1.20E+01	4.00E+00	1.70E+01	1.20E+01	4.00E+00
Di-n-butyl phthalate	6.80E-02	8.10E-01	1.80E+00	6.80E-02	6.80E-02
Dibenz(a,h)anthracene	1.90E+00	7.80E-01	1.80E+00	1.80E+00	7.80E-01
Dibenzofuran	1.50E+00	6.70E-01	1.90E+00	1.50E+00	6.70E-01
Fluoranthene	3.20E+01	9.80E+00	7.80E+01	3.20E+01	9.80E+00
Fluorene	2.50E+00	7.70E-01	1.70E+00	1.70E+00	7.70E-01
Indeno(1,2,3-cd)pyrene	4.60E+00	1.70E+00	5.70E+00	4.60E+00	1.70E+00
Naphthalene	2.10E+00	9.40E-01	3.20E+00	2.10E+00	9.40E-01
Phenanthrene	1.80E+01	5.90E+00	2.70E+01	1.80E+01	5.90E+00
Pyrene	1.70E+01	6.20E+00	4.10E+01	1.70E+01	6.20E+00
bis(2-Ethylhexyl)phthalate	1.30E+01	2.80E+00	1.40E+01	1.30E+01	2.80E+00
Volatile Organics					
1,1,2,2-Tetrachloroethane	2.70E-03	5.90E-03	7.70E-03	2.70E-03	2.70E-03
1,1-Dichloroethane	1.60E-03	5.90E-03	7.90E-03	1.60E-03	1.60E-03
2-Butanone (MEK)	4.80E-02	1.40E-02	2.30E-02	2.30E-02	1.40E-02
Acetone	2.60E-01	5.80E-02	1.50E-01	1.50E-01	5.80E-02
Benzene	2.10E-02	5.40E-03	6.80E-03	6.80E-03	5.40E-03
Carbon disulfide	9.20E-03	5.80E-03	7.90E-03	7.90E-03	5.80E-03
Chlorobenzene	2.10E+00	1.30E-01	1.90E-01	1.90E-01	1.30E-01

TABLE 3-12

EXPOSURE POINT CONCENTRATIONS
ON-BASE EAST SOLDIER CREEK SEDIMENTS
(CURRENT SCENARIO)

Chemical	Maximum Detected Concentration (mg/kg)	Mean[a,b] (mg/kg)	UCL[a,b,c] (mg/kg)	RME Exposure Point Concentration[d] (mg/kg)	Average Exposure Point Concentration[e] (mg/kg)
Chloromethane	2.50E-02	1.20E-02	1.70E-02	1.70E-02	1.20E-02
Ethylbenzene	8.10E-03	6.10E-03	8.40E-03	8.10E-03	6.10E-03
Methylene chloride	2.10E-02	5.00E-03	6.50E-03	6.50E-03	5.00E-03
Styrene	3.60E-02	8.10E-03	1.20E-02	1.20E-02	8.10E-03
Trichloroethene	1.90E-03	5.90E-03	7.70E-03	1.90E-03	1.90E-03

Notes:

a. Surface (0-0.5 feet) sediment data are used in the calculations.

b. One half the detection limit is used for all nondetects when calculating values.

c. The upper 95 percent confidence limit values (UCL) of the arithmetic mean concentration assuming lognormal distribution.

d. The concentration associated with the 95 percent UCL or the maximum concentration detected, whichever was lower, was used as the RME exposure point concentration.

e. The RME exposure point concentration or the mean concentration, whichever was lower, was adopted as the average exposure point concentration.

TABLE 3-13

EXPOSURE POINT CONCENTRATIONS
ON-BASE EAST SOLDIER CREEK SEDIMENTS
(FUTURE SCENARIO)

Chemical	Maximum Detected Concentration (mg/kg)	Mean[a,b] (mg/kg)	UCL[a,b,c] (mg/kg)	RME Exposure Point Concentration[d] (mg/kg)	Average Exposure Point Concentration[e] (mg/kg)
Metals					
Antimony	7.60E+00	4.90E+00	5.30E+00	5.30E+00	4.90E+00
Beryllium	8.20E-01	4.50E-01	5.90E-01	5.90E-01	4.50E-01
Cadmium	8.40E+02	5.80E+01	4.60E+02	4.60E+02	5.80E+01
Chromium	2.80E+03	4.20E+02	9.10E+02	9.10E+02	4.20E+02
Cobalt	5.00E+01	1.20E+01	1.60E+01	1.60E+01	1.20E+01
Lead	5.30E+02	1.40E+02	3.40E+02	3.40E+02	1.40E+02
Mercury	8.30E+00	7.00E-01	1.10E+00	1.10E+00	7.00E-01
Nickel	1.40E+03	1.30E+02	2.20E+02	2.20E+02	1.30E+02
Silver	1.50E+01	4.50E+00	8.20E+00	8.20E+00	4.50E+00
Thallium	1.30E+02	1.40E+02	1.90E+02	1.30E+02	1.30E+02
Vanadium	8.30E+01	2.50E+01	3.00E+01	3.00E+01	2.50E+01
Pesticides/PCBs					
4,4'-DDD	4.20E-02	6.80E-02	2.00E-01	4.20E-02	4.20E-02
Aroclor 1254	1.40E+01	1.60E+00	4.90E+00	4.90E+00	1.60E+00
Endosulfan II	9.30E-02	7.10E-02	2.30E-01	9.30E-02	7.10E-02
gamma-Chlordane	2.30E-02	3.50E-02	1.10E-01	2.30E-02	2.30E-02
Semivolatile Organics					
1,2-Dichlorobenzene	2.20E-01	7.30E-01	1.10E+00	2.20E-01	2.20E-01
1,4-Dichlorobenzene	1.10E+00	7.50E-01	1.30E+00	1.10E+00	7.50E-01
1-Chloronaphthalene	2.30E-01	4.30E+00	1.40E+01	2.30E-01	2.30E-01
2-Chloronaphthalene	5.00E-01	7.00E-01	1.30E+00	5.00E-01	5.00E-01
2-Methylnaphthalene	4.50E+00	7.70E-01	1.50E+00	1.50E+00	7.70E-01
Acenaphthene	2.20E+00	6.50E-01	1.10E+00	1.10E+00	6.50E-01
Anthracene	4.40E+00	9.20E-01	1.80E+00	1.80E+00	9.20E-01

TABLE 3-13

EXPOSURE POINT CONCENTRATIONS
ON-BASE EAST SOLDIER CREEK SEDIMENTS
(FUTURE SCENARIO)

Chemical	Maximum Detected Concentration (mg/kg)	Mean[a,b] (mg/kg)	UCL[a,b,c] (mg/kg)	RME Exposure Point Concentration[d] (mg/kg)	Average Exposure Point Concentration[e] (mg/kg)
Benzo(a)anthracene	9.10E+00	2.20E+00	5.90E+00	5.90E+00	2.20E+00
Benzo(a)pyrene	1.10E+01	2.30E+00	6.10E+00	6.10E+00	2.30E+00
Benzo(b)fluoranthene	1.30E+01	2.80E+00	9.30E+00	9.30E+00	2.80E+00
Benzo(g,h,i)perylene	4.50E+00	1.20E+00	2.80E+00	2.80E+00	1.20E+00
Benzo(k)fluoranthene	1.20E+01	2.20E+00	6.00E+00	6.00E+00	2.20E+00
Chrysene	1.20E+01	3.00E+00	9.40E+00	9.40E+00	3.00E+00
Di-n-butylphthalate	3.00E-01	7.10E-01	1.30E+00	3.00E-01	3.00E-01
Dibenz(a,h)anthracene	1.90E+00	6.20E-01	1.00E+00	1.00E+00	6.20E-01
Dibenzofuran	1.50E+00	6.20E-01	1.10E+00	1.10E+00	6.20E-01
Fluoranthene	3.20E+01	7.60E+00	2.70E+01	2.70E+01	7.60E+00
Fluorene	2.50E+00	6.50E-01	1.10E+00	1.10E+00	6.50E-01
Indeno(1,2,3-cd)pyrene	4.60E+00	1.20E+00	2.40E+00	2.40E+00	1.20E+00
Naphthalene	4.00E+00	9.60E-01	2.20E+00	2.20E+00	9.60E-01
Phenanthrene	1.80E+01	4.30E+00	1.50E+01	1.50E+01	4.30E+00
Pyrene	1.70E+01	4.60E+00	1.70E+01	1.70E+01	4.60E+00
bis(2-Ethylhexyl)phthalate	1.90E+01	3.50E+00	9.90E+00	9.90E+00	3.50E+00
VolatileOrganics					
2-Butanone (MEK)	4.80E-02	4.00E-02	3.60E-02	3.60E-02	3.60E-02
Acetone	2.60E-01	7.90E-02	1.50E-01	1.50E-01	7.90E-02
Carbon disulfide	9.20E-03	2.00E-02	1.40E-02	9.20E-03	9.20E-03
Chlorobenzene	1.80E+01	6.90E-01	6.90E-01	6.90E-01	6.90E-01
Chloromethane	2.50E-02	3.90E-02	2.90E-02	2.50E-02	2.50E-02
Ethylbenzene	8.10E-03	2.00E-02	1.50E-02	8.10E-03	8.10E-03
Methylene chloride	2.10E-02	1.90E-02	1.30E-02	1.30E-02	1.30E-02
Styrene	3.60E-02	2.10E-02	1.70E-02	1.70E-02	1.70E-02

TABLE 3-13

EXPOSURE POINT CONCENTRATIONS
ON-BASE EAST SOLDIER CREEK SEDIMENTS
(FUTURE SCENARIO)

Chemical	Maximum Detected Concentration (mg/kg)	Mean[a,b] (mg/kg)	UCL[a,b,c] (mg/kg)	RME Exposure Point Concentration[d] (mg/kg)	Average Exposure Point Concentration[e] (mg/kg)
Toluene	1.30E-02	2.00E-02	1.50E-02	1.30E-02	1.30E-02
Xylenes (total)	6.10E-03	2.00E-02	1.40E-02	6.10E-03	6.10E-03

Notes:

a Sediment data from all depths are used in the calculations.

b One half the detection limit is used for all nondetects when calculating values.

c The upper 95 percent confidence limit values (UCL) of the arithmetic mean concentration assuming lognormal distribution.

d The concentration associated with the 95 percent UCL or the maximum concentration detected, whichever was lower, was used as the RME exposure point concentration.

e The RME exposure point concentration or the mean concentration, whichever was lower, was adopted as the average exposure point concentration.

TABLE 3-14

EXPOSURE POINT CONCENTRATIONS
OFF-BASE EAST SOLDIER CREEK SEDIMENTS
(CURRENT AND FUTURE SCENARIOS)

Chemical	Maximum Detected Concentration (mg/kg)	Mean[a,b] (mg/kg)	UCL[a,b,c] (mg/kg)	RME Exposure point Concentration[d] (mg/kg)	Average Exposure Point Concentration[c] (mg/kg)
Metals					
Antimony	4.80E+00	4.20E+00	4.90E+00	4.80E+00	4.20E+00
Beryllium	6.70E-01	3.60E-01	9.00E-01	6.70E-01	3.60E-01
Cadmium	2.50E+01	7.50E+00	3.90E+02	2.50E+01	7.50E+00
Cobalt	8.10E+00	4.70E+00	8.70E+00	8.10E+00	4.70E+00
Mercury	1.00E-01	4.90E-02	9.40E-02	9.40E-02	4.90E-02
Thallium	1.30E+02	7.10E+01	1.40E+02	1.30E+02	7.10E+01
Vanadium	2.70E+01	1.70E+01	2.80E+01	2.70E+01	1.70E+01
Pesticides/PCBs					
Dieldrin	2.10E-03	4.70E-01	7.30E+02	2.10E-03	2.10E-03
Endosulfan II	2.10E-03	4.70E-01	7.30E+02	2.10E-03	2.10E-03
Semivolatile Organics					
1,4-Dichlorobenzene	4.20E-02	3.60E-01	1.10E+00	4.20E-02	4.20E-02
1-Chloronaphthalene	4.90E-02	1.90E+00	8.60E+01	4.90E-02	4.90E-02
2-Methylnaphthalene	1.30E-01	3.70E-01	7.60E-01	1.30E-01	1.30E-01
Benzo(b)fluoranthene	4.00E-02	3.60E-01	1.20E+00	4.00E-02	4.00E-02
Chrysene	4.70E-02	3.40E-01	1.50E+00	4.70E-02	4.70E-02
Fluoranthene	8.30E-01	3.10E-01	5.90E-01	5.90E-01	3.10E-01
Isophorone	4.70E-01	4.10E-01	8.10E-01	4.70E-01	4.10E-01
Phenanthrene	6.40E-02	3.60E-01	9.30E-01	6.40E-02	6.40E-02
Pyrene	2.80E-01	1.90E-01	2.60E-01	2.60E-01	1.90E-01
bis(2-Ethylhexyl)phthalate	5.20E+00	1.40E+00	1.50E+01	5.20E+00	1.40E+00
Volatile Organics					
2-Butanone (MEK)	8.30E-03	6.00E-03	7.00E-03	7.00E-03	6.00E-03
Acetone	3.30E-02	1.20E-02	1.90E-02	1.90E-02	1.20E-02
Carbon disulfide	4.50E-03	3.10E-03	4.00E-03	4.00E-03	3.10E-03

TABLE 3-14

EXPOSURE POINT CONCENTRATIONS
OFF-BASE EAST SOLDIER CREEK SEDIMENTS
(CURRENT AND FUTURE SCENARIOS)

Chemical	Maximum Detected Concentration (mg/kg)	Mean[a,b] (mg/kg)	UCL[a,b,c] (mg/kg)	RME Exposure point Concentration[d] (mg/kg)	Average Exposure Point Concentration[e] (mg/kg)
Chlorobenzene	1.50E-01	2.10E-02	1.10E-01	1.10E-01	2.10E-02
Methylene chloride	2.10E-03	2.70E-03	3.20E-03	2.10E-03	2.10E-03

Notes:

a Sediment data from all depths are used in the calculations.

b One half the detection limit is used for all nondetects when calculating values.

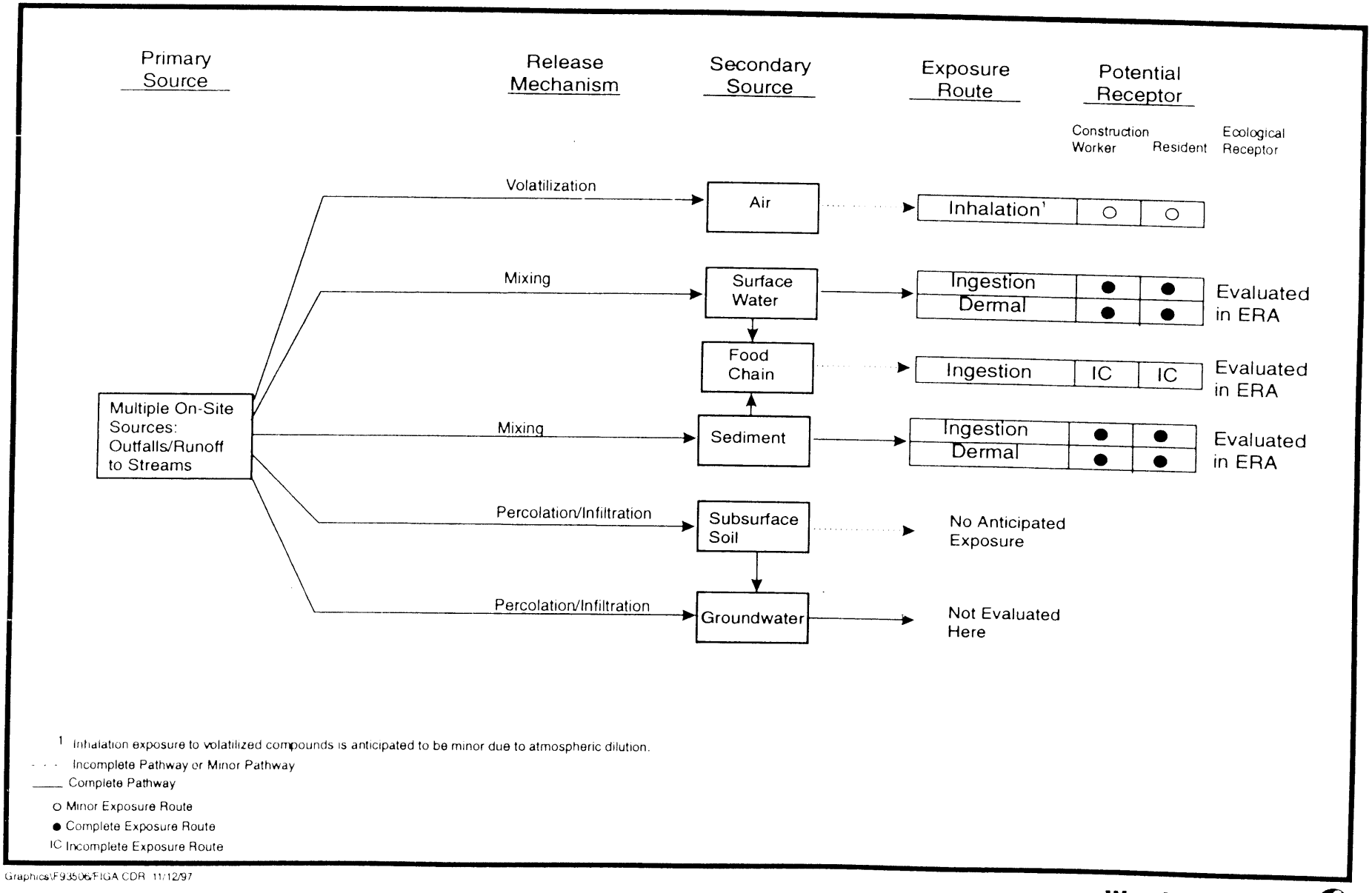
c The upper 95 percent confidence limit values (UCL) of the arithmetic mean concentration assuming lognormal distribution.

d The concentration associated with the 95 percent UCL or the maximum concentration detected, whichever was lower, was used as the RME exposure point concentration.

e The RME exposure point concentration or the mean concentration, whichever was lower, was adopted as the average exposure point concentration

FIGURE 3-1

Site Conceptual Exposure Model - East and West Soldier Creek
Tinker Air Force Base, Oklahoma City, Oklahoma



Graphics\F93506\FIGA CDR 11/12/97

Woodward-Clyde Consultants

4.0
TOXICITY ASSESSMENT

In general, the COCs identified in West and East Soldier Creeks consist of volatile and semivolatile organic compounds, PCBs, pesticides, and metals. The toxicity assessment provides the critical toxicity values (CTVs) for the COCs. The CTVs are values developed by the USEPA that are used to evaluate potential cancer risks and noncarcinogenic health hazards associated with chemical exposure.

4.1 TOXICITY ASSESSMENT OF NONCARCINOGENIC EFFECTS

The noncarcinogenic CTV is known as the reference dose (RfD). Reference doses are based on the premise that noncarcinogenic (i.e., toxic) effects exhibit a threshold. As long as the chronic daily intake (CDI) of a compound is less than the reference dose, no noncarcinogenic health effect is believed to be posed by the exposure. RfDs doses are developed using human and animal studies, and incorporate safety factors to ensure health protection in the most sensitive population.

Substances that produce noncarcinogenic effects are generally thought to have a threshold below which there are no observable adverse health effects. This threshold dose, also known as no-observed-adverse-effect level (NOAEL), is the highest level (determined in epidemiologic studies or animal studies) at which there is no statistically or biologically significant effects of concern, often called the "critical toxic effect." For certain substances, only a LOAEL, or "lowest-observed-adverse-effect level," has been determined. This is the lowest dose of a substance that produces either a statistically or biologically significant indication of the critical toxic effect. The NOAEL or the LOAEL may be used to calculate the RfD of a particular chemical.

RfDs are calculated by dividing the NOAEL (or LOAEL) by uncertainty factors, which generally range from 10 to 1,000. For example, uncertainties include variations in the sensitivity of individuals within a population and the extrapolation of data from experimental animals to humans. The RfD is expressed in units of milligrams of chemical per kilogram of body weight per day (mg/kg-day) for oral exposure.

Dermal RfDs can be derived from oral RfDs by adjusting the oral value to account for the percent of gastrointestinal absorption associated with the study used to derive the RfD (i.e., converting the oral RfD from an "administered" to an "absorbed" dose). However, this approach is not currently recommended by USEPA's Dermal Exposure Assessment: Principles and Applications because of metabolic differences between exposure rates (i.e., oral vs. dermal exposures) (USEPA 1992a). USEPA currently recommends use of oral RfDs to evaluate dermal exposure, although it should be noted that this approach may lead to an underestimation of dermal risk for some compounds (USEPA 1992a). The methodology for deriving RfDs is more fully described in the RAGS (USEPA 1989a).

The USEPA defines a chronic RfD as an estimate of a daily exposure level for the human population that is unlikely to result in deleterious effects during a lifetime (i.e., 70 years according to USEPA guidance). A chronic RfD is used to evaluate the potential noncarcinogenic hazards associated with long-term chemical exposures (7 years to a lifetime). Chronic RfDs for the COCs are shown in **Table 4-1**. For the ingestion route, the RfD is for the administered dose (assuming 100 percent absorption by the gastrointestinal tract) unless otherwise noted. This assumption enhances the conservatism of the RA since many chemicals in the environment are not readily absorbed by the gastrointestinal tract. RfDs have also been developed from many of the carcinogens to account for their noncarcinogenic effects.

The potential for noncarcinogenic effects to occur as a result of exposure is evaluated by comparing the exposure level, or daily chemical intake, over a specified time period (e.g., subchronic or chronic) with a RfD derived for a similar exposure period. A Hazard Quotient (HQ) is derived for each chemical as follows:

$$HQ = [Average\ Daily\ Intake] / [RfD]$$

If exposure is equivalent to or less than the RfD, the HQ will be 1.0 or less, which represents an intake level unlikely to be associated with potential adverse effect due to the chemical. If exposure exceeds the RfD, the resulting HQ will exceed 1.0, and it will be concluded that a hazard may exist. For each noncarcinogenic chemical of potential concern specific to each

exposure pathway, an HQ will be derived. HQs for each chemical are then summed for each exposure pathway to derive a value referred to as a Hazard Index (HI):

$$HI = HQ1 + HQ2 + HQ3 \ldots\ldots\ldots\ldots + HQn$$

HIs greater than 1.0 are generally viewed as indicating that exposure to a particular medium identified in the exposure scenario represents a potential human health hazard. Exposure pathway HIs are summed across pathways whenever appropriate, since individuals may be simultaneously exposed to chemicals via more than one pathway (e.g., to both soil and surface water).

4.2 TOXICITY ASSESSMENT OF CARCINOGENIC EFFECTS

The carcinogenic CTV is termed the slope factor (SF). Slope factors are developed based on a dose-response curve for carcinogenicity of the specific chemicals. As with RfD values, slope factors are developed from human and animal studies and are designed to be health protective (i.e., to overestimate the actual risks). The SF is used to estimate an upperbound probability of an individual developing cancer as a result of exposure to a potential carcinogen. Carcinogens with USEPA-derived SFs are also given an USEPA weight-of-evidence classification whereby potential carcinogens are grouped according to the likelihood that the chemical is a human carcinogen, depending on the quality and quantity of carcinogenic potency data for a given chemical. **Table 4-2** presents the USEPA weight-of-evidence classification system.

In estimating the risk posed by potential carcinogens, it is the common practice of the USEPA and other regulatory agencies to assume that any exposure level is associated with a finite probability, however minute, of producing a carcinogenic response. The USEPA assumes that a small number of molecular events can evoke changes in a single cell that can lead to uncontrolled cellular proliferation. This mechanism for carcinogenicity is referred to as "non-threshold" since there is theoretically no level of exposure for such a substance that does not pose a small, though finite, probability of producing a carcinogenic response.

SFs are based primarily on the results of animal studies. There is uncertainty whether all animal carcinogens are also carcinogenic in humans. While many chemical substances are carcinogenic in one or more animal species, only a certain number of chemical substances are known to be human carcinogens. The EPA assumes that humans are as sensitive to all animal carcinogens as the most sensitive animal species. This policy decision is designed to prevent underestimating risk and introduces the potential to overestimate carcinogenic risk.

It is generally assumed by the USEPA in developing SFs that the risk of cancer is linearly related to the dose. A linearized multistage model is commonly used by the USEPA for low-dose extrapolation of experimentally derived data to the low dose range. This conservative mathematical model is based on the multistage theory of carcinogenesis wherein the response is assumed to be linear at low doses. From the slope of the extrapolation curve estimated by the model, the USEPA calculates the upper 95th percent confidence limit of the slope. This value, the SF, expressed in units of $(mg/kg\text{-}day)^{-1}$, is used to convert the average daily intake of chemical, normalized over a lifetime, directly to a cancer risk. This represents an estimation of an upperbound incremental lifetime probability that an individual will develop cancer as a result of exposure to a potential carcinogen. This model provides a conservative estimate of cancer risk at low doses, and is likely to overestimate the actual cancer risk. The USEPA acknowledges that actual SFs are likely to be between zero and the estimate provided by the linearized multistage model (USEPA 1989a). The SFs and weight-of-evidence classifications for the COCs are included in **Table 4-1**.

Risks associated with individual COCs can be derived by multiplying the SF and the estimated CDI (i.e., average daily intake for entire lifetime) for each exposure pathway as follows:

$$\textit{Risk Estimate} = \textit{CDI} \times \textit{SF}$$

An overall risk estimate for each exposure scenario can be calculated by combining the risk estimates for individual chemicals and exposure routes. Risk estimates are then compared with the USEPA's acceptable risk range of 1×10^{-4} (1 in 10,000) to 1×10^{-6} (1 in 1,000,000) incremental excess lifetime cancer risk (USEPA 1990).

4.3 SOURCES OF CRITICAL TOXICITY VALUES

The RfD and SF values listed in the present RA were obtained from the following sources:

- USEPA's Integrated Risk Information System on-line database system (USEPA 1997a)
- USEPA Region III Risk-based Concentration Table (USEPA Region III 1997b)
- USEPA's Health Effects Assessment Summary Tables (USEPA 1994)

TABLE 4-1

CRITICAL TOXICITY VALUES

Chemical Name	Cancer Class	Oral RfD mg/kg-day	Oral SF (mg/kg-day)$^{-1}$
1,2-Dichlorobenzene	D	9.00E-02 [a]	
1,4-Dichlorobenzene	B2		2.40E-02 [b]
1,1-Dichloroethane	C	1.00E-01 [b]	
1-Chloronaphthalene		3.00E-02 [i]	
1,1,2,2-Tetrachloroethane	C		2.00E-01 [a]
2,4-Dimethylphenol		2.00E-02 [a]	
2-Butanone (MEK)	D	6.00E-01 [a]	
2-Chloronaphthalene		8.00E-02 [a]	
2-Methylnaphthalene	D	3.00E-02 [i]	
3-Methylchloanthrene		NTF	NTF
Acenaphthene		6.00E-02 [a]	
Acenaphthylene		3.00E-02 [i]	
Acetone	D	1.00E-01 [a]	
Acetophenone	D	1.00E-01 [a]	
Aldrin	B2	3.00E-05 [a]	1.70E+01 [a]
alpha-Chlordane	B2	6.00E-05 [a,c]	1.30E+00 [a,c]
Anthracene	D	3.00E-01 [a]	
Antimony	D	4.00E-04 [a]	
Aroclor 1254	B2	2.00E-05 [a]	2.00E+00 (upperbound) 1.00E+00 (central tendency)
Aroclor 1260	B2		2.00E+00 (upperbound) 1.00E+00 (central tendency)
Arsenic	A	3.00E-04 [a]	1.50E+00 [a]
Benzene	A		2.90E-02 [a]
Benzidine	A	3.00E-03 [a]	2.30E+02 [a]
Benzo(a)anthracene	B2		7.30E-01 [h]
Benzo(a)pyrene	B2		7.30E+00 [a]
Benzo(b)fluoranthene	B2		7.30E-01 [h]
Benzo(g,h,i)perylene		3.00E-02 [i]	
Benzo(k)fluoranthene	B2		7.30E-02 [h]
Benzoic acid	D	4.00E+00 [a]	
Beryllium	B2	5.00E-03 [a]	4.30E+00 [a]
Bis(2-ethylhexyl) phthalate	B2	2.00E-02 [a]	1.40E-02 [a]
Bromoform	B2	2.00E-02 [a]	7.90E-03 [a]
Bromomethane	D	1.40E-03 [a]	
Butyl benzyl phthalate	C	2.00E-01 [a]	
Cadmium (Food)	B1	1.00E-03 [a]	
Cadmium (water)	B1	5.00E-04 [a]	
Carbon disulfide		1.00E-01 [a]	
Chlorobenzene		2.00E-02 [a]	
Chloromethane	B2		1.30E-02 [b]
Chromium (III)	D	1.00E+00 [a]	
Chromium (VI)	A	5.00E-03 [a]	
Chrysene	B2		7.30E-03 [h]

TABLE 4-1

CRITICAL TOXICITY VALUES

Chemical Name	Cancer Class	Oral RfD mg/kg-day	Oral SF (mg/kg-day)$^{-1}$
Cobalt		6.00E-02 [g]	
DDD	B2		2.40E-01 [a]
DDE	B2		3.41E-01 [a]
Di-n-butyl phthalate	D	1.00E-01 [a]	
Di-n-octyl phthalate		2.00E-02 [g]	
Dibenz(a,h)anthracene	B2		7.30E+00 [h]
Dibenzofuran	D	4.00E-03 [g]	
Dibromochloromethane	C	2.00E-02 [a]	8.40E-02 [a]
Dieldrin	B2	5.00E-05 [a]	1.60E+01 [a]
Endosulfan II		[illegible] [a,j]	
Ethanol		NTF	NTF
Ethylbenzene	D	1.00E-01 [a]	
Fluoranthene		4.00E-02 [a]	
Fluorene		4.00E-02 [a]	
Gamma-Chlordane	B2	6.00E-05 [a,c]	1.30E+00 [a,c]
Heptachlor epoxide	B2	1.30E-05 [a]	9.10+00 [a]
Indeno(1,2,3-cd)pyrene	B2		7.30E-01 [h]
Iodomethane		NTF	NTF
Isophorone	C	2.00E-01 [a]	9.50E-04 [a]
Lead	B2	NTF	NTF
Methylene chloride	B2	6.00E-02 [a]	7.50E-03 [a]
Mercury	D	3.00E-04 [b,g]	
Naphthalene	D	3.00E-02 [d,i]	
Nickel	A	2.00E-02 [a,e]	
Phenanthrene	D	3.00E-02 [i]	
Pyrene	D	3.00E-02 [a]	
Silver	D	5.00E-03 [a]	
Styrene		2.00E-01 [a]	
Thallium	D	8.00E-05 [a,f]	
Toluene	D	2.00E-01 [a]	
Trichloroethene	B2	6.00E-03 [g]	1.10E-02 [g]
Vanadium	D	7.00E-03 [b]	
Vinyl chloride	A		1.90E+00 [b,g]
Xylenes (total)	D	2.00E+00 [a]	

Notes:

a). EPA's Integrated Risk Information System (USEPA November 1997) on-line database system.
b). EPA's Health Effects Assessment Summary Tables (USEPA 1994)
c). RfD and SF for chlordane
d) Data inadequate for quantitative risk assessment
e). Subchronic value is used.
f). RfD value for thallium (I) chloride is used.
g). EPA, Region III Risk-Based Concentration table (USEPA 1997).
h). Based on the slope factor of Benzo(a)pyrene x Carcinogenic Equivalency Factor (USEPA 1993).
i). The RfD value for pyrene is assumed as the surrogate RfD value for noncarcinogenic PAHs.
j). RfD for endosulfan
NTF = No toxicity factors. Surrogate toxicity values for these chemicals are not available, therefore, they were not evaluated in the quantitative risk assessment.

TABLE 4-2

USEPA WEIGHT-OF-EVIDENCE CARCINOGENIC CLASSIFICATION OF CHEMICALS

Group	Description	Description of Evidence
A	Human carcinogen	Sufficient evidence from epidemiologic studies to support a causal association between exposure and cancer.
B1 or B2	Probable human carcinogen	B1 indicates that limited human data are available from epidemiologic studies. B2 indicates sufficient evidence in animals and inadequate or no evidence in humans of carcinogenicity.
C	Possible human carcinogen	Limited evidence of carcinogenicity in animals.
D	Not classifiable as to human carcinogenicity	Inadequate evidence of carcinogenicity in animals.
E	No evidence of carcinogenicity in humans	No evidence of carcinogenicity in at least two adequate animal tests or in both epidemiologic and animal studies.

Note: Substances in Groups B and C are considered potential carcinogens.

5.0
CHARACTERIZATION OF POTENTIAL CANCER RISKS AND NONCARCINOGENIC HAZARDS

5.1 PROCEDURE FOR CALCULATION OF POTENTIAL CANCER RISKS AND NONCARCINOGENIC HAZARDS

The purpose of the risk characterization is to estimate the potential health risks associated with site chemicals. The potential health risks for each compound and exposure pathway are estimated in this Section of the RA. These risk estimates are calculated using the intake parameters developed in the exposure assessment (**Tables 3-1**, **3-2**, **3-3**, and **3-4**), the estimated exposure point concentrations (**Tables 3-5** to **3-14**), and the CTVs reported in the toxicity assessment (**Table 4-1**). The CDI calculations are discussed in **Section 3.6** and are presented in **Attachment A**. It should be noted that the CDIs used for calculating HQs are different from those used to estimate cancer risks (CRs). The CDIs used to calculate HQs are developed using the exposure period as an averaging period, while the CDIs used to calculate potential CRs assume lifetime as the averaging period. The approach for carcinogens is based on the assumption that a high dose received over a short period of time is equivalent to a low dose spread over a life-time, while the approach used for noncarcinogens assumes that chemical effects are only relevant during the period of exposure. The CDIs and their corresponding risks and hazards were calculated for each chemical using the arithmetic mean concentration to evaluate average exposure and the RME concentration to evaluate upperbound exposure.

As discussed in **Section 4.0**, the potential noncarcinogenic health hazard is calculated for each compound as the ratio of CDI and respective RfD. The ratio is termed the Hazard Quotient (HQ). The concept of HQ is based on the assumption that most toxicological effects of chemicals occur only after a threshold dose is achieved. The RfD for a compound is an estimate of the threshold concentration for the most sensitive human population associated with the lowest observed adverse effect for that compound. An HQ in excess of 1.0 indicates that the threshold has been exceeded and a potential health hazard may exist, while a value of less than 1.0 indicates the absence of a health hazard.

The summation of HQs for all compounds is termed the Hazard Index (HI). The assumption of additivity of sub-threshold HQ values in calculating an HI is only valid when the following conditions are met:

- All compounds affect the same target organ
- There are no antagonistic or synergistic effects between compounds (little is known about these interactions for most chemicals)

The first condition is not true for many chemicals, while the second assumption represents a major source of uncertainty. Assuming that no synergistic effects occur, the assumption of additivity does not appear to be valid for all compounds. The use of an HI in this RA should be considered highly conservative and will likely overestimate the potential for a health hazard.

Potential cancer risks are calculated for each compound as the arithmetic product of the CDI and the respective SF. The estimated cancer risk for each compound may be summed to yield an overall cancer risk for each scenario. The basis for this approach is the regulatory assumption that cancer risks are additive (USEPA 1989a). The approach is very conservative and likely to overestimate the true cancer risks associated with exposure to the chemicals of concern.

5.2 SUMMARY OF POTENTIAL NONCARCINOGENIC HEALTH HAZARD AND CANCER RISKS

The calculation of individual HQs and cancer risks for each receptor, exposure route and compound are presented in Attachment A and are summarized in **Tables 5-1** and **5-2**.

Both average exposure and RME hazard indices are less than the threshold value of 1.0 for all exposure scenarios and stream segments studied in this RA. This indicates that surface water and sediments in both West and East Soldier Creeks should not pose a noncarcinogenic health hazard to any on-Base or off-Base populations under current or future stream use conditions.

As shown on **Tables 5-1** and **5-2**, potential cancer risks associated with all scenarios are less than the Baseline risk level of 10^{-4} established by USEPA for identifying sites that require remedial action (USEPA 1991c). These results indicate that exposure to surface water and sediments in West and East Soldier Creeks are not likely to result in an unacceptable cancer risk for any on-Base or off-Base populations under current or future stream use conditions. (Note: Current and future estimated potential cancer risks and hazard indices from surface water exposure for Areas 1 and 3 are the same because there was only one set of data for each area.)

TABLE 5-1

NONCARCINOGENIC HEALTH HAZARDS AND CARCINOGENIC RISKS ASSOCIATED WITH SURFACE WATER AND SEDIMENTS IN SOLDIER CREEK (CURRENT SCENARIO)

	ON-BASE WORKER				OFF-BASE RESIDENT [a]			
	AVERAGE		RME		AVERAGE		RME	
	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK
ON-BASE WEST SOLDIER CREEK (AREA 1)								
SURFACE WATER INGESTION	0.00001	2E-10	0.0002	2E-08	NA	NA	NA	NA
SURFACE WATER DERMAL EXPOSURE	0.00001	2E-10	0.0004	4E-08	NA	NA	NA	NA
SEDIMENT INGESTION[b]	0.0006	4E-10	0.02	2E-07	NA	NA	NA	NA
SEDIMENTS DERMAL EXPOSURE[b]	0.00003	1E-10	0.008	4E-07	NA	NA	NA	NA
TOTAL	0.0006	9E-10	0.03	7E-07	NA	NA	NA	NA
OFF-BASE WEST SOLDIER CREEK (AREA 2)								
SURFACE WATER INGESTION	NA	NA	NA	NA	0.0001	1E-10	0.0003	8E-10
SURFACE WATER DERMAL EXPOSURE	NA	NA	NA	NA	0.0001	0E+00	0.0002	0E+00
SEDIMENT INGESTION[b]	NA	NA	NA	NA	0.02	6E-07	0.08	9E-06
SEDIMENTS DERMAL EXPOSURE[b]	NA	NA	NA	NA	0.001	2E-08	0.02	3E-06
TOTAL	NA	NA	NA	NA	0.02	6E-07	0.1	1E-05
ON-BASE EAST SOLDIER CREEK (AREA 3)								
SURFACE WATER INGESTION	0.00002	1E-10	0.0003	1E-08	NA	NA	NA	NA
SURFACE WATER DERMAL EXPOSURE	0.0003	5E-10	0.01	2E-07	NA	NA	NA	NA
SEDIMENT INGESTION[b]	0.0005	1E-09	0.03	5E-07	NA	NA	NA	NA
SEDIMENTS DERMAL EXPOSURE[b]	0.00003	4E-10	0.01	9E-07	NA	NA	NA	NA
TOTAL	0.0008	2E-09	0.05	2E-06	NA	NA	NA	NA
OFF-BASE EAST SOLDIER CREEK (AREA 4)								
SURFACE WATER INGESTION	NA	NA	NA	NA	0.001	6E-08	0.01	6E-07
SURFACE WATER DERMAL EXPOSURE	NA	NA	NA	NA	0.0005	3E-08	0.001	1E-07
SEDIMENT INGESTION[b]	NA	NA	NA	NA	0.1	4E-08	0.4	3E-07
SEDIMENTS DERMAL EXPOSURE[b]	NA	NA	NA	NA	0.001	7E-10	0.01	1E-08
TOTAL	NA	NA	NA	NA	0.1	1E-07	0.39	1E-06

Note:

a. The hazard indices or cancer risk associated with both adult and child resident

b. Surface (0-0.5 feet) sediments data are used in the calculations.

TABLE 5-2

NONCARCINOGENIC HEALTH HAZARDS AND CARCINOGENIC RISKS ASSOCIATED WITH SURFACE WATER AND SEDIMENTS IN SOLDIER CREEK (FUTURE SCENARIO)

	ON-BASE WORKER				OFF-BASE RESIDENT [a]			
	AVERAGE		RME		AVERAGE		RME	
	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK
ON-BASE WEST SOLDIER CREEK (AREA 1)								
SURFACE WATER INGESTION	0.00001	2E-10	0.0002	2E-08	NA	NA	NA	NA
SURFACE WATER DERMAL EXPOSURE	0.00001	2E-10	0.0004	4E-08	NA	NA	NA	NA
SEDIMENT INGESTION[b]	0.001	2E-09	0.03	6E-07	NA	NA	NA	NA
SEDIMENTS DERMAL EXPOSURE[b]	0.0001	7E-10	0.03	9E-07	NA	NA	NA	NA
TOTAL	0.001	3E-09	0.07	1E-06	NA	NA	NA	NA
OFF-BASE WEST SOLDIER CREEK (AREA 2)								
SURFACE WATER INGESTION	NA	NA	NA	NA	0.0001	1E-10	0.0003	8E-10
SURFACE WATER DERMAL EXPOSURE	NA	NA	NA	NA	0.0001	0E+00	0.0002	0E+00
SEDIMENT INGESTION[b]	NA	NA	NA	NA	0.02	6E-07	0.1	9E-06
SEDIMENTS DERMAL EXPOSURE[b]	NA	NA	NA	NA	0.001	2E-08	0.02	3E-06
TOTAL	NA	NA	NA	NA	0.02	6E-07	0.1	1E-05
ON-BASE EAST SOLDIER CREEK (AREA 3)								
SURFACE WATER INGESTION	0.00002	1E-10	0.0003	1E-08	NA	NA	NA	NA
SURFACE WATER DERMAL EXPOSURE	0.0003	5E-10	0.01	2E-07	NA	NA	NA	NA
SEDIMENT INGESTION[b]	0.001	8E-10	0.02	3E-07	NA	NA	NA	NA
SEDIMENTS DERMAL EXPOSURE[b]	0.00004	3E-10	0.01	5E-07	NA	NA	NA	NA
TOTAL	0.001	2E-09	0.05	1E-06	NA	NA	NA	NA
OFF-BASE EAST SOLDIER CREEK (AREA 4)								
SURFACE WATER INGESTION	NA	NA	NA	NA	0.001	6E-08	0.01	6E-07
SURFACE WATER DERMAL EXPOSURE	NA	NA	NA	NA	0.0005	3E-08	0.001	1E-07
SEDIMENT INGESTION[b]	NA	NA	NA	NA	0.1	4E-08	0.4	3E-07
SEDIMENTS DERMAL EXPOSURE[b]	NA	NA	NA	NA	0.001	7E-10	0.01	1E-08
TOTAL	NA	NA	NA	NA	0.1	1E-07	0.4	1E-06

Note:

a The hazard indices or cancer risk associated with both adult and child resident

b Sediment data collected from all depths are used in the calculations

6.0
REMEDIAL ACTION OBJECTIVES

The establishment of health-based Remedial Action Objectives (RAOs) (i.e., "cleanup goals") serves as an important means of guiding remedial activities. In general, development of health-based RAOs is warranted whenever a site is found to pose an unacceptable risk to either human health or the environment, and "cleanup" standards promulgated by state or federal agencies are not available. The approach used to develop health-based cleanup goals is derived from the RA process, which is a process whereby the magnitude of potential cancer risks and other health effects associated with site contaminants can be evaluated quantitatively. A human health-based cleanup goal is established by "back-calculating" a health protective contaminant concentration, given a target risk which is deemed acceptable, and using realistic intake factors to represent potentially exposed populations.

The approach used in this document to develop cleanup goals incorporates RME assumptions and reasonable site use scenarios so that residual risks posed by the site after corrective action are within a health-protective range. It is important to note that, since the RME is meant to represent the most exposed individual in a population, the estimates provided herein are conservative. That is, because cleanup goals developed using RME assumptions are health-protective of the most exposed individual in a population, they will be health-protective for all potentially exposed individuals within that population.

The approach used to calculate RAOs in this document is the same as that used in the previous RAs performed by WCFS (1996, 1997b). Risk-based RAOs were calculated for each chemical using the most conservative exposure scenario, that is, the scenario associated with the largest risk or hazard. For COCs found off-Base, the largest risks and hazards were associated with residential exposure scenarios. For COCs found only in the on-Base portions of the creek, the construction worker scenario is the only applicable scenario, and thus was used to calculate RAOs.

Human health RAOs are calculated based on both the carcinogenic and noncarcinogenic properties of the COCs. Four sets of human health RAOs are developed in this RA. For carcinogens, RAOs were calculated based on target risk levels of 10^{-6} (one in a million), 10^{-5}

(one in one hundred thousand), and 10^{-4} (one in ten thousand). These three values encompass the acceptable risk range of 10^{-6} to 10^{-4} identified by USEPA. For noncarcinogens, RAOs were calculated based on a target Hazard Index of 1.0. The equations used to calculate RAOs are presented below. These equations were used by WCFS (1996, 1997b) and were used here to preserve continuity between the RAs previously prepared by WCFS (1996, 1997b) and this current RA.

For carcinogens

RAO = (Risk Assessment Concentration/Calculated Risk) (Target Risk)

For noncarcinogens

RAO = (Risk Assessment Concentration/Calculated Hazard) (Target Hazard)

where

Risk Assessment Concentration = The maximum chemical exposure point concentration used in the RA

Calculated Risk = The highest calculated risk associated with the exposure point concentration

Target Risk = 10^{-6}, 10^{-5}, and 10^{-4}

Calculated Hazard = The highest calculated hazard associated with the exposure point concentration

Target Hazard = 1.0

The RAOs for chemicals in sediment are summarized in **Table 6-1**. For chemicals with both carcinogenic and noncarcinogenic RAOs, the lower level of these values is the health-protective value. Because surface water in the creek is a dynamic medium that is constantly changing, it is inappropriate to develop RAOs for chemicals in surface water. However, by using the same approach in calculating the RAOs, health-based indicators of water quality were developed for chemicals in surface water and are summarized in **Table 6-2**.

TABLE 6-1
RISK-BASED CLEANUP LEVELS
FOR CHEMICALS IN SEDIMENTS

Chemical	RME[a] (mg/kg)	Dermal HQ	Ingestion HQ	Total HQ[b]	Dermal Cancer Risk	Ingestion Cancer Risk	Total Cancer Risk	Noncarcinogenic Action Level[c] (mg/kg)	Carcinogenic Action Level[d] (Risk = 1 x 10-6) (mg/kg)	Carcinogenic Action Level[d] (Risk = 1 x 10-5) (mg/kg)	Carcinogenic Action Level[d] (Risk = 1 x 10-4) (mg/kg)
1,1,2,2-Tetrachloroethane	2.70E-03				3.7E-12	1.89E-12	5.59E-12		4.83E+02	4.83E+03	4.83E+04
1,1-Dichloroethane	1.60E-03	3.07E-10	1.57E-10	4.64E-10				3.45E+06 [e]			
1,2-Dichlorobenzene	7.30E-01	1.56E-07	7.94E-08	2.35E-07				3.10E+06 [e]			
1,4-Dichlorobenzene	1.10E+00				1.81E-11	9.23E-11	1.10E-10		9.96E+03	9.96E+04	9.96E+05
1-Chloronaphthalene	2.30E-01	1.47E-07	7.50E-08	2.22E-07				1.04E+06 [e]			
2,4-Dimethylphenol	6.40E-02	6.14E-08	3.13E-08	9.27E-08				6.90E+05			
2-Butanone (MEK)	3.60E-02	1.15E-10	5.87E-10	7.02E-10				5.13E+07 [e]			
2-Chloronaphthalene	5.00E-01	1.20E-07	6.12E-08	1.81E-07				2.76E+06 [e]			
2-Methylnaphthalene	1.50E+00	9.59E-07	4.89E-07	1.45E-06				1.04E+06 [e]			
3-Methylcholanthrene	2.50E-01							NA	NA	NA	NA
4,4'-DDD	4.20E-02				6.9E-11	3.52E-11	1.04E-10		4.03E+02	4.03E+03	4.03E+04
4,4'-DDE	8.50E-03				1.99E-11	1.01E-11	3.00E-11		2.83E+02	2.83E+03	2.83E+04
Acenaphthene	1.80E+01	5.75E-07	2.94E-07	8.69E-07				2.07E+07 [e]			
Acenaphthylene	4.30E-02	2.75E-08	1.40E-08	4.15E-08				1.04E+06 [e]			
Acetone	1.50E-01	2.88E-08	1.47E-08	4.35E-08				3.45E+06 [e]			
Acetophenone	1.10E-01	2.11E-08	1.08E-08	3.19E-08				3.45E+06 [e]			
Aldrin	6.70E-03	4.28E-06	2.19E-06	6.47E-06	7.80E-10	3.98E-10	1.18E-09	1.04E+03	5.69E+00	5.69E+01	5.69E+02
alpha-Chlordane	1.30E-02	4.16E-06	2.12E-06	6.28E-06	1.16E-10	5.91E-11	1.75E-10	2.07E+03	7.42E+01	7.42E+02	7.42E+03
gamma-Chlordane	2.30E-02	7.35E-06	3.75E-06	1.11E-05	2.05E-10	1.04E-10	3.09E-10	2.07E+03	7.44E+01	7.44E+02	7.44E+03
Anthracene	4.00E+00	2.56E-07	1.30E-07	3.86E-07				1.04E+07 [e]			
Antimony	5.60E+00	2.68E-05	1.37E-04	1.64E-04				3.42E+04			
Aroclor 1254	3.00E+01	2.88E-02	1.47E-02	4.35E-02	4.11E-07	0.000000105	5.16E-07	6.90E+02	5.81E+01	5.81E+02	5.81E+03
Aroclor 1260	6.80E-01				9.32E-09	4.57E-09	1.39E-08		4.90E+01	4.90E+02	4.90E+03
Benzene	6.80E-03				1.35E-12	6.89E-13	2.04E-12		3.33E+03	3.33E+04	3.33E+05
Benzidine	2.20E-01	1.41E-06	7.18E-07	2.13E-06				1.03E+05			
Benzo(a)anthracene	9.10E+00				4.55E-08	2.32E-08	6.87E-08		1.32E+02	1.32E+03	1.32E+04
Benzo(a)pyrene	1.10E+01				5.50E-07	2.81E-07	8.31E-07		1.32E+01	1.32E+02	1.32E+03
Benzo(b)fluoranthene	1.30E+01				6.50E-08	3.32E-08	9.82E-08		1.32E+02	1.32E+03	1.32E+04
Benzo(g,h,i)perylene	4.50E+00	2.88E-06	1.47E-06	4.35E-06				1.03E+06 [e]			
Benzo(k)fluoranthene	1.20E+01				6.00E-09	3.06E-09	9.06E-09		1.32E+03	1.32E+04	1.32E+05
Benzoic acid	2.80E-01	1.34E-09	6.85E-10	2.03E-09				1.38E+08 [e]			
Beryllium	1.20E+00	4.60E-07	2.35E-06	2.81E-06	3.53E-09	1.80E-08	2.15E-08	4.27E+05	5.57E+01	5.57E+02	5.57E+03
bis(2-Ethylhexyl)phthalate	1.30E+01	1.25E-05	6.36E-06	1.89E-05	1.25E-09	6.36E-10	1.89E-09	6.89E+05	6.89E+03	6.89E+04	6.89E+05
Butyl benzyl phthalate	5.10E-01	4.89E-08	2.50E-08	7.39E-08				6.90E+06 [e]			
Cadmium	8.37E+02	1.61E-03	8.19E-03	9.80E-03				8.54E+04			
Carbon disulfide	9.20E-03	1.76E-10	9.00E-10	1.08E-09				8.55E+06 [e]			
Chlorobenzene	1.90E-01	1.82E-07	9.30E-08	2.75E-07				6.91E+05			
Chloromethane	4.00E-03				3.56E-13	1.82E-14	3.74E-13		1.07E+04	1.07E+05	1.07E+06
Chromium VI	8.40E+00	1.35E-05	3.72E-04	3.86E-04				2.18E+04			
Chromium	1.80E+03	6.90E-04	3.52E-03	4.21E-03				4.28E+05			
Chrysene	1.20E+01				6.00E-10	3.06E-10	9.06E-10		1.32E+04	1.32E+05	1.32E+06
Cobalt	4.50E+01	1.44E-06	7.34E-06	8.78E-06				5.13E+06 [e]			
Di-n-butyl phthalate	3.00E-01	5.75E-08	2.94E-08	8.69E-08				3.45E+06 [e]			
Di-n-octyl phthalate	6.60E-01	2.66E-06	7.31E-06	9.97E-06				6.62E+04			
Dibenz(a,h)anthracene	1.80E+00				9.00E-08	4.59E-08	1.36E-07		1.32E+01	1.32E+02	1.32E+03
Dibenzofuran	1.50E+00	7.19E-06	3.67E-06	1.09E-05				1.38E+05			
Dieldrin	2.10E-03	3.39E-06	9.31E-06	1.27E-05	1.16E-09	3.19E-09	4.35E-09	1.65E+02	4.83E-01	4.83E+00	4.83E+01

TABLE 6-1
RISK-BASED CLEANUP LEVELS
FOR CHEMICALS IN SEDIMENTS

Chemical	RME[a] (mg/kg)	Dermal HQ	Ingestion HQ	Total HQ[b]	Dermal Cancer Risk	Ingestion Cancer Risk	Total Cancer Risk	Noncarcinogenic Action Level[c] (mg/kg)	Carcinogenic Action Level[d] (Risk = 1 x 10-6) (mg/kg)	Carcinogenic Action Level[d] (Risk = 1 x 10-5) (mg/kg)	Carcinogenic Action Level[d] (Risk = 1 x 10-4) (mg/kg)
Endosulfan II	9 30E-02	2 97E-07	1 52E-07	4 49E-07				2 07E+05			
Ethanol											
Ethylbenzene	8 10E-03	1 55E-09	7 93E-10	2 34E-09				3 46E+06 [e]			
Fluoranthene	3 20E+01	1 53E-05	7 83E-06	2 31E-05				1 38E+06 [e]			
Fluorene	1 70E+00	8 15E-07	4 16E-07	1 23E-06				1 38E+06 [e]			
Heptachlor epoxide	2 80E-03	4 13E-06	2 11E-06	6 24E-06	1 75E-10	8 90E-11	2 64E-10	4 49E+02	1 06E+01	1 06E+02	1 06E+03
Indeno(1,2,3-cd)pyrene	4 60E+00				2 3E-08	1 17E-08	3 47E-08		1 33E+02	1 33E+03	1 33E+04
Isophorone	4 70E-01	1 89E-07	5 21E-07	7 10E-07	1 54E-11	4 24E-11	5 78E-11	6 62E+05	8 13E+03	8 13E+04	8 13E+05
Lead	5 28E+02							NA	NA	NA	NA
Mercury	3 50E+00	2 24E-05	1 14E-04	1 36E-04				2 57E+04			
Methylene chloride	1 30E-02	4 16E-09	2 12E-09	6 28E-09	6 68E-13	3 41E-13	1 01E-12	2 07E+06 [e]	1 29E+04	1 29E+05	1 29E+06
Naphthalene	2 20E+00	1 41E-06	7 18E-07	2 13E-06				1 03E+06 [e]			
Nickel	2 20E+02	2 11E-05	2 61E-06	2 37E-05				9 28E+06 [e]			
Phenanthrene	1 80E+01	1 15E-05	5 87E-06	1 74E-05				1 04E+06 [e]			
Pyrene	1 70E+01	1 09E-05	5 54E-06	1 64E-05				1 03E+06 [e]			
Silver	1 70E+02	6 52E-05	3 33E-04	3 98E-04				4 27E+05			
Styrene	1 70E-02	1 63E-09	8 32E-10	2 46E-09				6 90E+06 [e]			
Thallium	1 30E+02	3 12E-03	1 59E-02	1 90E-02				6 83E+03			
Toluene	1 30E-02	1 25E-10	6 36E-10	7 61E-10				1 71E+07 [e]			
Trichloroethene	1 90E-03	6 07E-09	3 10E-09	9 17E-09	1 43E-14	7 30E-14	8 73E-14	2 07E+05	2 18E+04	2 18E+05	2 18E+06
Vanadium	5 60E+01	1 53E-05	7 83E-05	9 36E-05				5 98E+05			
Vinyl chloride	2 80E-03				3 64E-11	1 86E-11	5 50E-11		5 09E+01	5 09E+02	5 09E+03
Xylenes (total)	6 10E-03	5 85E-12	2 98E-11	3 57E-11				1 71E+08 [e]			

Note a) RME = Reasonable Maximum Exposure Concentration
b) HQ = Hazard Quotient
c) Cleanup level = (Risk Assessment Conc/HQ) x HI where HI = 1 0
d) Cleanup level = (Risk Assessment Conc/Cancer risk) x Target cancer Risk
e) Calculated cleanup level is greater than 100% concentration and 100% concentration is assigned as the cleanup level
NA = Not Applicable These chemicals do not have critical toxicity values, therefore, risk-based cleanup levels could not be calculated

TABLE 6-2

RISK-BASED CLEANUP LEVELS
FOR CHEMICALS IN SURFACE WATER

Chemical	RME[a] (mg/L)	Ingestion HQ	Dermal HQ	Total HQ[b]	Ingestion Cancer Risk	Dermal Cancer Risk	Total Cancer Risk	Noncarcinogenic[c] Clean-up Level (mg/L)	Carcinogenic[d] Clean-up Level (Risk = 1 x 10^{-6}) (mg/L)	Carcinogenic[c] Clean-up Level (Risk = 1 x 10^{-5}) (mg/L)	Carcinogenic[d] Clean-up Level (Risk = 1 x 10^{-4}) (mg/L)
Acetone	6.10E-03	4.77E-07		4.77E-07				1.28E+04			
Antimony	2.50E-04	4.89E-06	9.59E-06	1.45E-05				1.73E+01			
Aroclor 1254	5.00E-04	1.96E-04	1.23E-02	1.25E-02				4.00E-02			
Arsenic	3.80E-03	9.92E-05	1.94E-04	2.93E-04	1.59E-08	3.12E-08	4.71E-08	1.30E+01	8.07E-02	8.07E-01	8.07E+00
bis(2-ethylhexyl)phthalate	5.70E-03	2.23E-06	1.40E-04	1.42E-04	2.23E-10	1.40E-08	1.42E-08	4.01E+01	4.01E-01	4.01E+00	4.01E+01
Bromoform	1.60E-03	6.26E-07		6.26E-07	3.53E-11		3.53E-11	2.56E+03	4.53E+01	4.53E+02	4.53E+03
Bromomethane	7.20E-03	1.67E-04		1.67E-04				4.31E+01			
Cadmium	3.30E-03	5.17E-05	1.01E-04	1.53E-04				2.16E+01			
Cobalt	1.80E-03	2.35E-07	4.60E-07	6.95E-07				2.59E+03			
Chloromethane	1.10E-03				4.00E-11		4.00E-11		2.75E+01	2.75E+02	2.75E+03
Dibromochloromethane	1.80E-03	7.05E-07		7.05E-07				2.55E+03			
Ethanol	4.10E-02							NA	NA	NA	NA
Iodomethane	1.80E-03							NA	NA	NA	NA
Methylene chloride	1.30E-03	1.70E-07		1.70E-07	2.73E-11		2.73E-11	7.65E+03	4.76E+01	4.76E+02	4.76E+03
Nickel	1.30E-02	5.09E-06	9.97E-06	1.51E-05				8.63E+02			
Silver	4.70E-04	7.36E-07	1.44E-06	2.18E-06				2.16E+02			
Styrene	3.40E-03	1.33E-07		1.33E-07				2.56E+04			
Vanadium	4.90E-03	5.48E-06	1.07E-05	1.62E-05				3.03E+02			

Note: a) RME = Reasonable Maximum Exposure concentration
b) HQ = Hazard Quotient
c) Cleanup level = (Risk Assessment Conc/HQ) x HI where HI = 1.0
d) Cleanup level = (Risk Assessment Conc/Cancer risk) x Target Cancer Risk
NA = Not Applicable. These chemicals do not have critical toxicity values, therefore, risk-based cleanup levels could not be calculated.

7.0
UNCERTAINTY ANALYSIS

The USEPA guidance for RA provides a systematic means for organizing, analyzing, and presenting information on the nature and magnitude of potential risks to public health posed by chemical exposures. Despite the advanced state of the current methodology, uncertainties and limitations are inherent in the RA process. The uncertainty can lead to an over- or underestimation of the risk. **Table 7-1** presents a qualitative assessment of factors which may contribute to uncertainty in the estimation of potential risks. Available data quality, incomplete information about existing conditions and future circumstances, as well as other factors discussed below contribute to these uncertainties and limitations.

This section discusses the following sources of uncertainties associated with the Soldier Creek RA:

- Data collection and evaluation
- Exposure assessment
- Toxicity assessment
- Risk characterization
- Remedial Action Objectives

7.1 DATA COLLECTION AND EVALUATION

7.1.1 Data Collection

Data used in this RA were collected from East and West Soldier Creeks during two semiannual sampling events as part of the long-term monitoring of Soldier Creek. These data are subject to uncertainty associated with sampling and analysis.

7.1.1.1 Sampling

It was assumed in the RA that samples collected were representative of areas where various populations may be exposed. However, collected samples may not be completely representative due to biases in sampling, random variability, or sources of non-random variation, such as the annual precipitation cycle or periodic releases from on-Base or off-Base outfalls. These sources of bias or variability may result in either an over- or underestimation of actual chemical concentrations and, subsequently, site risks.

7.1.1.2 Analysis

Samples were analyzed and subjected to data quality review procedures to assure that the data were suitable for use in decision-making. However, it should be understood that sample analysis is subject to uncertainties associated with precision and accuracy and evaluated through laboratory quality assurance (QA) programs. Uncertainties associated with precision and accuracy of analysis are generally random. While these errors are typically of low magnitude compared to other sources of uncertainty in the RA, they may lead to a possible over- or underestimation of risk.

7.1.2 Data Evaluation

In accordance with EPA guidance, several inorganic chemicals present at background concentrations were removed from consideration as potential COCs because they are not site-related contaminants. This exclusion process was not extended to organic chemicals, because it is difficult to establish true background levels for most organics. Nonetheless, it is likely that several of the organic chemicals identified as COCs are present at background levels, and are not site-related contaminants. Inclusion of these chemicals in the risk calculations will result in an overestimation of site-related risks.

7.2 EXPOSURE ASSESSMENT

The exposure assessment is based on a series of assumptions concerning concentrations of chemicals to which humans are exposed (exposure point concentrations) and patterns of behavior leading to exposure or intake of chemicals (exposure scenarios).

7.2.1 Exposure Point Concentrations

In compiling data for use in the RA, arithmetic mean concentrations and 95th percentile UCL on the mean concentrations were compiled for chemicals detected in each medium. For RME exposure scenarios, the 95th percentile UCL concentrations were used to estimate risk. Because UCL concentrations are high end values, typically closer to maximum concentrations than to the arithmetic mean concentrations, use of UCL concentrations in the RA will likely result in an overestimation of potential risk.

For the most part, the arithmetic mean and 95th percentile UCL chemical concentrations found in the four areas of East and West Soldier Creeks evaluated in this RA were used as exposure point concentrations. It was conservatively assumed that chemical concentrations observed at the creeks will remain unchanged with time. The potential reduction in chemical concentrations by remedial action, migration, degradation, or attenuation were not considered in the current RA. The use of existing chemical concentrations projected into the future may result in an overestimation of potential health risks.

When calculating exposure point concentrations it was assumed that a chemical not detected in a given sample was actually present at one-half of its detection limit, if that chemical was present in any sample from that medium and stream segment. This approach, as described in the RAGS (USEPA 1989a), is a conservative approach that is likely to lead to an overestimation of risk, particularly when the quantification limits are high (due to interferences or sample dilution during analysis) or the only measured concentrations are "**J**" coded values less than the detection limits.

The use of statistical methods to calculate exposure point concentrations can result in calculated concentrations that exceed the maximum measured concentrations, particularly

when the sample size is small and the standard deviation of the results is large. Use of a statistical approach to calculate exposure point concentrations when the sample size is small or standard deviation is large is likely to result in an overestimation of risk.

7.2.2 Exposure Scenarios

The exposure assessment relied on a number of assumptions for potential human exposure. Assumptions used were based on:

- Site-specific information (including information provided in the Baseline Risk Assessments [B&V 1993 and WCFS 1996e])
- RAGS (USEPA 1989a), the Exposure Factors Handbook (USEPA 1989b), and Dermal Exposure Assessment: Principles and Applications (USEPA 1992a)
- Professional judgment

The average case scenarios represent assumptions which are considered central values, or realistically conservative estimates for the exposed population. However, even the average case exposure scenario is conservative because it assumes individuals are exposed on a regular basis over a long period of time and, therefore, likely to overestimate risk. RME scenarios are developed to provide an upper bound risk estimate. The RME scenarios are based upon a combination of conservative assumptions for all variables related to exposure and, therefore, are highly likely to overestimate potential risks.

In some cases (e.g., the dermal permeability constants), published information for one chemical has been assumed to be representative of other related chemicals. These assumptions may lead to over- or underestimation of risk. The general approach used in this assessment was to use conservative assumptions for intake variables in the absence of strong scientific data, thus minimizing the likelihood that risks are underestimated.

7.3 TOXICITY ASSESSMENT

7.3.1 Uncertainties Associated with Critical Toxicity Values

In general, the available scientific information is insufficient to provide a thorough understanding of all the potential toxic properties of chemicals to which humans are potentially exposed. Consequently, varying degrees of uncertainty surround the assessment of adverse health effects among exposed populations. Sources of uncertainty related directly to toxicity data include:

- Use of dose-response data from experiments on homogenous, sensitive animal populations to predict effects in heterogeneous human populations with a wide range of sensitivities

- Extrapolation of data from: 1) high dose animal studies to low dose human exposures; 2) acute or subchronic exposure; and 3) one exposure route to another (e.g., from ingestion to inhalation or dermal absorption)

- Use of single-chemical test data that does not account for multiple exposures or synergistic and antagonistic responses

- Critical toxicity values (RfDs or SFs) are predicted values for the most sensitive subpopulations

A high degree of overall uncertainty may be associated with the Critical Toxicity Values used in the RA because there are numerous potential sources of uncertainty associated with the basic toxicology data. In an attempt to minimize the consequences of uncertainty, USEPA guidance typically relies on a conservative approach, applying numerous safety factors to the toxicity data to insure the Critical Toxicity Values used in the RA are protective of all sensitive human populations. Use of these critical toxicity values is highly likely to overestimate potential risk.

7.3.2 Uncertainties Associated with the Use of Surrogates

Some of the detected COCs don't have EPA-established critical toxicity values. Without a CTV, a chemical cannot be evaluated in the quantitative risk assessment. Consequently, surrogate compounds in this RA were identified for chemicals without CTVs of their own. The CTV of the surrogate compound was used to represent potential toxicity of the other chemical. There is uncertainty associated with this approach because there is insufficient data to show whether or not the two chemicals have similar toxicities. As a result, this approach may under- or overestimate risks.

For some chemicals without CTVs of their own, no appropriate surrogates could be identified. Lead, ethanol, iodomethane, and 3-methylcholanthrene were determined to have no CTVs of their own and no appropriate surrogates. Therefore, these chemicals could not be evaluated in the quantitative RA and potential risks may have been underestimated.

7.4 RISK CHARACTERIZATION

Because there are uncertainties in each step of the risk assessment process, uncertainties are often magnified in the final risk characterization. The final quantitative estimates of risk may be one or several orders of magnitude different from the potential risk associated with the given exposure. Because of the conservative approaches used in each step, the overall results of the RA are more likely to overestimate than underestimate the potential risk associated with contaminants in Soldier Creek.

7.5 REMEDIAL ACTION OBJECTIVES

Remedial action objectives are developed for the COCs using exposure assumptions developed in the exposure assessment and critical toxicity values identified in the toxicity assessment. All of the uncertainties associated with selection of COCs, development of exposure assumptions, and use of USEPA-derived toxicity values also apply to the calculation of remedial action objectives. Because of the inherent conservatism within the risk assessment process, the resulting remedial action objectives are likely to be overly conservative.

TABLE 7-1

SUMMARY OF UNCERTAINTIES ASSOCIATED WITH RISK ASSESSMENT FOR SOLDIER CREEK

Assumptions	Estimated Magnitude of Effect on Risk	Direction of Effect on Risk Estimate
Data Collection and Evaluation		
Samples collected were representative of conditions to which various populations may be exposed.	Low - Moderate	May over- or underestimate risk.
Errors in chemical analysis	Low	May over- or underestimate risk.
High detection limit	Low-Moderate	May over- or underestimate risk.
For RME exposure scenarios, the 95th percentile UCL concentrations were used to estimate risk.	Low - Moderate	Likely result in an overestimate of risk.
Inclusion of background level organic compounds in the risk calculation.	Low - Moderate	May overestimate site-related risks.
Exposure Assessment		
Use of existing chemical concentrations projected into the future	Low - Moderate	May overestimate site-related risks.
Chemical concentrations reported as "below method detection limit" are used at one-half detection limit when calculating mean chemical concentration	Low - Moderate	May over- or underestimate risk, but usually overestimate risk.
Use combination of conservative assumptions to estimate RME associated risks.	Moderate	May over- or underestimate risk.
Toxicity Assessment		
The use of conservative USEPA models for developing Slope Factors (SF)	Moderate - High	May overestimate risk.
The Reference Dose (RfD) for a compound is an estimate of the threshold concentration for the most sensitive human population associated with the lowest observed adverse effect for that compound	Moderate - High	May overestimate risk.
For some chemicals without a critical toxicity value of their own, a surrogate compound was identified and its critical toxicity value was used to evaluate the chemical in the quantitative risk assessment.	Moderate	May over- or underestimate risk.
Critical toxicity values weren't available for some identified COCs. Appropriate surrogates could not be identified for some chemicals without critical toxicity values. Therefore, these chemicals couldn't be evaluated in the quantitative risk assessment.	Low - Moderate	May underestimate risk.
Hazard indices (HIs) were developed assuming all toxic effects were additive	Low - Moderate	May overestimate risk.
Risk Characterization		
Conservative approaches used in each step	Moderate - High	May overestimate risk.
Remedial Action Objectives		
All the uncertainties associated with COC selection, exposure assumption development, and EPA-derived toxicity values are used.	Moderate - High	Likely to be overly conservative.

8.0
TRENDS

Two RAs of East and West Soldier Creeks were previously completed by WCFS in 1996 and 1997 (WCFS 1996e, 1997b). The results of the first and second year risk assessments indicated that there were no unacceptable human health risks associated with the contaminant concentrations detected in sediments and surface water along these Soldier Creek tributaries.

Contaminants and their concentrations are continuously changing along the length of Soldier Creek and its tributaries. Because of the dynamics of the Soldier Creek system, the results of the first and second year RAs were compared to the results of this current risk assessment to evaluate any trends which may be occurring.

Tables 8-1 and **8-2** show the comparison of first year, second year, and third year noncarcinogenic health hazards and carcinogenic risks from surface water and sediments for on-Base workers under the current and future use scenarios, respectively.

Table 8-3 shows the comparison of first year, second year, and third year off-Base resident noncarcinogenic health hazards and carcinogenic risks from exposure to surface water and sediments under current and future use scenarios.

Individual COC contributions to the HIs and cancer risks of the third year RA are presented in Attachment A.

8.1 AREA 1: ON-BASE WEST SOLDIER CREEK

In general, there are no significant changes in the potential hazard indices and cancer risks (i.e., all three reports show HIs below 1.0 and cancer risks within or below the target risk range of 1×10^{-6} to 1×10^{-4}). The estimated cancer risks for the third year RA were slightly lower than the first or second year RAs. The HIs have fluctuated over the three years, but remain at the same general level. These changes are likely due to the differences in the COCs and their concentrations between the three years.

Sediments

More pesticides and phthalates were detected in the first year and third year monitoring than in the second year. Data from the second and third years showed more chlorinated benzenes detected than in the first year. For COCs detected all three years, concentrations fluctuated from the first to the third year. In general, the second year had the highest concentrations of the three RAs. The metals detected from one year to the next were similar; however, the concentrations for some of these metals were significantly lower (by a factor of 2 or more) in the third year compared to the second year.

For the current Base worker exposure scenario, the HI for noncarcinogenic health effects appears to be slightly lower in the third year RA compared to the first and second year RAs. Third-year cancer risks appear to be slightly lower than those estimated in the first and second year RAs. The dermal and ingestion exposure routes contribute equally to the cancer risks and noncarcinogenic health effects for all three RAs (see Table 8-1). Benzidine was the largest contributor to the cancer risk for the first and second years. Aroclor 1254 was the largest contributor to the HIs for the first and second years. Benzo(a)pyrene was the largest contributor to the cancer risk for the third year RA. Thallium was the major contributor to the noncarcinogenic health effects for the third year RA.

For the future Base worker exposure scenario, both the second year HIs and cancer risks appear to be slightly higher than were previously estimated in the first year RA. The third year RA had estimated HIs and cancer risks slightly lower than the second year RA and similar to the first year RA. These small variations in estimated risks between the two RAs are likely due to the changes in the detected COCs and their concentrations. The dermal and ingestion exposure routes appear to contribute evenly in the three RAs (see Table 8-2). Benzidine was the major contributor to the cancer risks all three years. Aroclor 1254 was the major contributor to the HIs all three years.

Surface Water

As with sediments, the COCs varied between the RAs. The chemical groups which varied the most were volatiles and semivolatiles. More volatiles were detected in the second year

RA than in the first and third year RAs. The semivolatiles detected for the third year RA were different from those in the second year RA.

In general, both current and future estimated HI and cancer risks from surface water along the on-Base portion of Soldier Creek are lower for the second year RA than those estimated in the first and third year reports. Dermal contact with surface water was the primary exposure pathway for all three RAs. Metals were the major contributors to the HI for all three RAs. Arsenic was the primary contributor to the cancer risk in the third year RA. No carcinogenic chemicals were detected in surface water along this creek segment during the second year of monitoring.

8.2 AREA 2: OFF-BASE WEST SOLDIER CREEK

The off-Base residential HIs for this segment of Soldier Creek were approximately one order of magnitude higher in the second and third year RAs than in the first year RA (Table 8-3). Potential estimated off-Base residential cancer risks were higher for the third year RA than the first and second year RAs (Table 8-3). Again, the dynamics of the creek system resulted in different COC lists and concentrations between the two years.

Sediments

Overall, more chemicals were considered as COCs in the first and third years than in the second year. More pesticides were detected in the first year than in the second and third years, and polycyclic aromatic hydrocarbons (PAH) concentrations were markedly higher in the third year than in the second year. The current and future off-Base residential exposure scenarios for the second year RA indicated slightly higher estimated HIs and slightly lower cancer risks in the second year than were estimated in the first year RA. The third year HIs are similar to the second year HIs. Cancer risks for the third year are higher than the first two years.

The cancer risks and noncarcinogenic health effects for all three RAs were primarily driven by ingestion of sediments. Aroclor 1254 was the major contributor to the HIs for all three

RAs. Benzidine was the major carcinogenic contributor for the second year RA. PAHs were the major contributor to cancer risks in the first and third year RAs.

Surface Water

More metals were considered as COCs in the second and third year RAs than in the first year RA. Fewer volatiles were considered as COCs in the second year RA than in the first and third year RAs.

A comparison of potential risks for Area 2 surface water indicated that both the HIs and cancer risks were lower in the second year RA than were estimated in the first year RA. The third year HIs and cancer risks from surface water are in general lower than the first year and slightly higher than the second year. Although the COCs varied, the COCs detected in the third year do not appear to have resulted in risks significantly higher than those compounds considered COCs in the first and second year RAs.

Dermal contact was the primary pathway of concern for surface water exposures. Metals were the major contributors to the HIs for all three RAs. Metals and bromomethane were the major contributors to the third year RA HIs. Arsenic was the major contributor to cancer risks in the first RA. No carcinogenic compounds were detected; therefore, there were no cancer risks from surface water for the second year RA along this creek segment. Chloromethane was the major contributor to the third year RA cancer risks.

8.3 AREA 3: ON-BASE EAST SOLDIER CREEK

In general, there are no significant changes in the potential HIs and cancer risks between the three RAs. The HIs have risen slightly from the first year. The estimated cancer risks have decreased from the first year to the third year. These changes are likely due to the differences in detected COCs and their concentrations.

Sediments

Fewer chemicals were considered COCs in the second year than in the first year RA. More pesticides and metals were detected in the second and third years. Several SVOCs and aldrin were detected at significantly higher concentrations in the second year than in the first year. However, pesticides and SVOC concentrations (especially PAHs) were lower in the third year than in the second year.

For the current Base worker exposure scenarios, estimated HIs were slightly higher in the third year than in the second year. Cancer risks were slightly lower in the third year RA than in the second year RA. The cancer risks and noncarcinogenic health effects for the third year RA were primarily driven by ingestion (see Table 8-1). Second year RA cancer risks and noncarcinogenic health effects for the second year were driven by dermal exposure. The first year RA noncarcinogenic health effects and cancer risks were driven by ingestion of sediments. Aroclor 1254 was the major contributor to the HI for the first and second year RAs. Thallium and Aroclor 1254 were the major contributors to HI for the third year RA. Benzidine and PAHs were the major contributors to the cancer risks for the first and second year RAs. PAHs and Aroclor 1254 were the major contributors to the cancer risks for the third year RA.

For the future Base worker exposure scenarios, third year estimated HIs were slightly higher and cancer risks were mostly lower than indicated in the first and second year RAs (see Table 8-2). The noncarcinogenic health effects for the second and third year RAs were primarily driven by ingestion of thallium and Aroclor 1254 in sediments. The cancer risks were primarily driven by dermal contact with Aroclor 1254 and PAHs.

The cancer risks and noncarcinogenic health effects for the first year RA were primarily driven by dermal contact. Aroclor 1254, and benzidine and PAHs were the major contributors to the HI and cancer risks, respectively.

Surface Water

Bis(2-ethylhexyl) phthalate was the only SVOC considered to be a COC in surface water for the third year RA. More metals and SVOCs were considered COCs in the second year than in the first year. No pesticides were considered COCs in the 2nd year RA; however, pesticides were included in the first and third year RAs. Aroclor 1254 was the only pesticide considered to be a COC for the third year RA. Several different volatiles were considered COCs in the second year RA than in the first year RA, and concentrations of recurring volatile COCs were approximately two (2) times higher in the second year than those detected for the first year RA. In general, concentrations of volatile COCs for the third year RA were similar or slightly lower than the second year RA concentrations.

For the Base worker exposure scenarios, estimated potential cancer risks were slightly higher in the second year RA than those for the first and third year RAs, and HIs were slightly lower in the second year RA. Cancer risks were slightly higher in the second year than the first and third year RAs, and HIs were higher in the first and third year RAs.

The cancer risks and noncarcinogenic health effects were primarily driven by dermal contact in all three RAs. Metals were the major contributors to the HIs for the first and second year RAs. Aroclor 1254 is the major contributor to the HI for the third year RA. Aroclor 1254 was also the major contributor to the cancer risks for the third year RA. Benzidine was the major carcinogenic contributor in the second year RA. Aldrin was the major contributor to the cancer risks in the first year RA.

8.4 AREA 4: OFF-BASE EAST SOLDIER CREEK

Overall, the off-Base residential cancer risks for this segment of Soldier Creek were lower in the third year RA than in the first and second year RAs (see Table 8-3). HIs were higher in the third year RA than in the second year RA. Creek dynamics, again, influenced the HIs and cancer risks by changing the COCs and detected concentrations.

Sediments

Fewer SVOCs were considered COCs in the third year RA than in the first and second year RAs, especially fewer PAHs (both carcinogenic and noncarcinogenic). Additionally, the detected concentrations of PAHs in the third year were significantly lower than in the first and second year RAs.

For current and future off-Base residential exposure scenarios, the estimated cancer risks were lower in the third year than those estimated in the first and second year RAs (see Table 8-3). HIs were slightly higher than the first and second year RAs.

Third year RA cancer risks and noncarcinogenic health effects were primarily driven by ingestion of sediments. Thallium and cadmium were the major contributors to the HI for the third year RA. Aroclor 1254 and cadmium were the major contributors to the HI for the first and second year RAs. Beryllium was the major contributor to the carcinogenic risks for the third year RA. Beryllium and benzo(a)pyrene were the major carcinogenic contributors for the second year RA. Pesticides were a major contributor to cancer risks in the first year RA.

Surface Water

Bis(2-ethylhexyl) phthalate was the only SVOC considered to be a COC for the third year RA. No pesticides/PCBs were considered to be COCs for this RA. The detected pesticides and semivolatile organics considered to be COCs in the second year RA were significantly different than those identified as COCs in the first year RA. Additionally, the concentrations of COCs in the second and third year RAs were lower than in the first year RA.

Estimated HIs and cancer risks were slightly lower for dermal exposures to surface water than those indicated in the first and second year RAs. Ingestion HIs and cancer risks were higher in the third year RA.

Ingestion of surface water was the primary driver for cancer risks and noncarcinogenic health effects in the first and third year RAs. The cancer risks and noncarcinogenic health effects were primarily driven by dermal contact in the second year RA. Metals were the major

contributors to the HI, and arsenic was the major carcinogenic risk contributor for the first and third year RAs. 4,4-DDT and 2,6-dichlorophenol were the major contributors to the second year HIs. 4,4-DDT was also the major carcinogenic contributor in the second year RA.

TABLE 8-1
COMPARISON OF FIRST THREE YEARS
NONCARCINOGENIC HEALTH HAZARDS AND CARCINOGENIC RISKS ASSOCIATED WITH
SURFACE WATER AND SEDIMENTS IN SOLDIER CREEK
(CURRENT BASE WORKER SCENARIO)

	ON-BASE WORKER (3rd Year)				ON-BASE WORKER (2nd Year)				ON-BASE WORKER (1st Year)			
	AVERAGE		RME		AVERAGE		RME		AVERAGE		RME	
	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK
ON-BASE WEST SOLDIER CREEK (AREA 1)												
SURFACE WATER INGESTION	0.00001	2E-10	0.0002	2E-08	0.000002	1E-12	0.0001	2E-10	0.00001	5E-10	0.0002	6E-08
SURFACE WATER DERMAL EXPOSURE	0.00001	2E-10	0.0004	4E-08	0.000001	0E+00	0.0001	0E+00	0.000004	1E-09	0.0005	4E-07
SEDIMENT INGESTION	0.001	4E-10	0.02	2E-07	0.0004	3E-09	0.04	3E-07	0.0001	3E-08	0.01	5E-06
SEDIMENTS DERMAL EXPOSURE	0.00003	1E-10	0.008	4E-07	0.0001	1E-09	0.06	7E-07	0.00002	1E-08	0.02	9E-06
TOTAL	0.001	9E-10	0.03	7E-07	0.0005	4E-09	0.1	1E-06	0.0001	4E-08	0.04	1E-05
OFF-BASE WEST SOLDIER CREEK (AREA 2)												
SURFACE WATER INGESTION	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SURFACE WATER DERMAL EXPOSURE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SEDIMENT INGESTION	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SEDIMENTS DERMAL EXPOSURE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TOTAL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ON-BASE EAST SOLDIER CREEK (AREA 3)												
SURFACE WATER INGESTION	0.00002	1E-10	0.0003	1E-08	0.000003	8E-09	0.0001	8E-07	0.00002	1E-10	0.001	2E-08
SURFACE WATER DERMAL EXPOSURE	0.0003	5E-10	0.01	2E-07	0.00001	8E-09	0.0004	2E-06	0.00002	2E-10	0.002	2E-07
SEDIMENT INGESTION	0.0005	1E-09	0.03	5E-07	0.0004	4E-09	0.02	7E-07	0.0002	1E-07	0.02	2E-05
SEDIMENTS DERMAL EXPOSURE	0.00003	4E-10	0.01	9E-07	0.0001	1E-09	0.02	1E-06	0.0001	4E-08	0.01	5E-05
TOTAL	0.0008	2E-09	0.05	2E-06	0.0005	2E-08	0.04	5E-06	0.0002	1E-07	0.03	4E-05
OFF-BASE EAST SOLDIER CREEK (AREA 4)												
SURFACE WATER INGESTION	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SURFACE WATER DERMAL EXPOSURE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SEDIMENT INGESTION	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SEDIMENTS DERMAL EXPOSURE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TOTAL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 8-2
COMPARISON OF FIRST THREE YEARS
NONCARCINOGENIC HEALTH HAZARDS AND CARCINOGENIC RISKS ASSOCIATED WITH
SURFACE WATER AND SEDIMENTS IN SOLDIER CREEK
(FUTURE BASE WORKER SCENARIO)

	ON-BASE WORKER (3rd Year)				ON-BASE WORKER (2nd Year)				ON-BASE WORKER (1st Year)			
	AVERAGE		RME		AVERAGE		RME		AVERAGE		RME	
	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK
ON-BASE WEST SOLDIER CREEK (AREA 1)												
SURFACE WATER INGESTION	0.00001	2E-10	0.0002	2E-08	0.000002	1E-12	0.0001	2E-10	0.00001	5E-10	0.0002	6E-08
SURFACE WATER DERMAL EXPOSURE	0.00001	2E-10	0.0004	4E-08	0.000001	0E+00	0.0001	0E+00	0.000004	1E-09	0.0005	4E-07
SEDIMENT INGESTION	0.001	2E-09	0.03	6E-07	0.0004	5E-09	0.03	6E-07	0.0001	3E-09	0.01	4E-07
SEDIMENTS DERMAL EXPOSURE	0.000	7E-10	0.03	9E-07	0.0001	2E-09	0.04	1E-06	0.00002	1E-09	0.03	8E-07
TOTAL	0.001	3E-09	0.07	1E-06	0.0005	7E-09	0.07	2E-06	0.0001	6E-09	0.04	2E-06
OFF-BASE WEST SOLDIER CREEK (AREA 2)												
SURFACE WATER INGESTION	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SURFACE WATER DERMAL EXPOSURE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SEDIMENT INGESTION	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SEDIMENTS DERMAL EXPOSURE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TOTAL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ON-BASE EAST SOLDIER CREEK (AREA 3)												
SURFACE WATER INGESTION	0.00002	1E-10	0.0003	1E-08	0.000003	8E-09	0.0001	8E-07	0.00002	1E-10	0.001	2E-08
SURFACE WATER DERMAL EXPOSURE	0.0003	5E-10	0.01	2E-07	0.00001	8E-09	0.0004	2E-06	0.00002	2E-10	0.002	2E-07
SEDIMENT INGESTION	0.001	8E-10	0.02	3E-07	0.0004	4E-09	0.01	6E-07	0.0001	8E-08	0.01	1E-05
SEDIMENTS DERMAL EXPOSURE	0.00004	3E-10	0.01	5E-07	0.00004	2E-09	0.009	1E-06	0.00004	3E-08	0.01	2E-05
TOTAL	0.001	2E-09	0.05	1E-06	0.0005	2E-08	0.02	4E-06	0.0002	1E-07	0.02	3E-05
OFF-BASE EAST SOLDIER CREEK (AREA 4)												
SURFACE WATER INGESTION	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SURFACE WATER DERMAL EXPOSURE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SEDIMENT INGESTION	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SEDIMENTS DERMAL EXPOSURE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TOTAL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 8-3
COMPARISON OF FIRST THREE YEARS
NONCARCINOGENIC HEALTH HAZARDS AND CARCINOGENIC RISKS ASSOCIATED WITH
SURFACE WATER AND SEDIMENTS IN SOLDIER CREEK
(CURRENT AND FUTURE OFF-BASE RESIDENTIAL SCENARIO)

	OFF-BASE RESIDENT (3rd Year)				OFF-BASE RESIDENT 2nd Year)				OFF-BASE RESIDENT (1st Year)			
	AVERAGE		RME		AVERAGE		RME		AVERAGE		RME	
	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK	HAZARD INDEX	CANCER RISK
ON-BASE WEST SOLDIER CREEK (AREA 1)												
SURFACE WATER INGESTION	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SURFACE WATER DERMAL EXPOSURE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SEDIMENT INGESTION	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SEDIMENTS DERMAL EXPOSURE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TOTAL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OFF-BASE WEST SOLDIER CREEK (AREA 2)												
SURFACE WATER INGESTION	0.0001	1E-10	0.0003	8E-10	0.00001	0E+00	0.0002	0E+00	0.0001	5E-09	0.0002	4E-08
SURFACE WATER DERMAL EXPOSURE	0.0001	0E+00	0.0002	0E+00	0.00002	0E+00	0.0002	0E+00	0.0001	3E-09	0.001	5E-08
SEDIMENT INGESTION	0.02	6E-07	0.1	9E-06	0.02	3E-07	0.1	1E-06	0.01	2E-07	0.03	2E-06
SEDIMENTS DERMAL EXPOSURE	0.001	2E-08	0.02	3E-06	0.001	1E-08	0.02	4E-07	0.0002	6E-09	0.01	6E-07
TOTAL	0.02	6E-07	0.1	1E-05	0.02	3E-07	0.1	2E-06	0.01	2E-07	0.03	2E-06
ON-BASE EAST SOLDIER CREEK (AREA 3)												
SURFACE WATER INGESTION	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SURFACE WATER DERMAL EXPOSURE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SEDIMENT INGESTION	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SEDIMENTS DERMAL EXPOSURE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
TOTAL	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
OFF-BASE EAST SOLDIER CREEK (AREA 4)												
SURFACE WATER INGESTION	0.001	6E-08	0.01	6E-07	0.0004	3E-10	0.002	3E-09	0.002	5E-08	0.01	4E-07
SURFACE WATER DERMAL EXPOSURE	0.0005	3E-08	0.001	1E-07	0.002	3E-08	0.005	2E-07	0.001	2E-08	0.002	1E-07
SEDIMENT INGESTION	0.1	4E-08	0.4	3E-07	0.003	1E-07	0.01	7E-07	0.01	3E-07	0.1	1E-06
SEDIMENTS DERMAL EXPOSURE	0.001	7E-10	0.01	1E-08	0.0001	1E-08	0.001	2E-07	0.0001	4E-08	0.002	3E-06
TOTAL	0.1	1E-07	0.4	1E-06	0.006	2E-07	0.02	1E-06	0.01	4E-07	0.2	5E-06

9.0
SUMMARY AND CONCLUSION

This RA has evaluated potential health hazards (i.e., noncarcinogenic effects) and cancer risks associated with exposure to surface water and sediment from portions of East and West Soldier Creek that may have been impacted by contaminant releases from Tinker AFB. Based on difference in contaminant sources and exposed populations, the following four different stream segments were evaluated quantitatively in this RA:

- West Soldier Creek, on-Base
- West Soldier Creek, off-Base
- East Soldier Creek, on-Base
- East Soldier Creek, off-Base

Chemicals of concern were identified based on the evaluation of chemical data from surface water and sediment samples collected by WCFS in the two semiannual sampling events of 1997. An evaluation of potential health risks has been performed for a group of exposure scenarios believed to represent potential forms of human activities that could occur at these areas. These exposure scenarios include the following:

- Construction workers involved in repair or installation of underground pipelines around or under on-Base portion of the creeks
- Residents wading or swimming in the off-Base portion of West and East Soldier Creeks

Swimming was only evaluated for the child scenario for East Soldier Creek; all other scenarios assume wading only. Potential health risks associated with surface water and sediment exposure were evaluated for both on-site construction workers and off-site residents. The results of the risk characterization indicate that potential cancer risks and noncarcinogenic health hazards for all scenarios are within or below the advisory range of 10^{-6} to 10^{-4} and 1.0, respectively. These results indicate that exposure to surface water and

sediments in West and East Soldier Creeks is not likely to result in an unacceptable cancer risk or noncarcinogenic hazard for any on-Base or off-Base populations under current or future stream use conditions.

As part of the RA, a set of cleanup goals was developed to identify health-protective levels for each COC. Although remediation does not appear to be warranted at the present time (based on risk to human health), these cleanup goals provide a set of "action criteria," should remedial action be required in the future.

A trend analysis was also done as part of this RA. The results of the comparison between this RA and the two previous RAs showed no dramatic changes. However, Area 4 cancer risks appear to be decreasing from the first year to the third year RA. The other three areas evaluated don't show any clear trends.

10.0
REFERENCES

Black and Veatch Waste Science Technology (B&V). 1993. Final Remedial Investigation Report, Tinker AFB - Soldier Creek RI/FS. April.

Environmental Criteria Assessment Office (ECAO). 1993.

Gilbert, R.O. 1987. Statistical Methods for Environmental Pollution Monitoring. Van Nostrand Reinhold Company. New York.

National Research Council (NRC). 1989. Recommended Dietary Allowances, Food and Nutrition Board, National Academy of Sciences.

Nelson, W.E. 1992. Nelson Textbook of Pediatrics. 14th edition. W.B. Saunders Co., Philadelphia, PA.

NUS Corporation (NUS). 1989. Final Storm Sewer Investigation for Soldier Creek. Report for Tinker Air Force Base, Oklahoma City, OK. October.

Parson Engineering Science (PES). 1996. Tinker AFB Soldier Creek/Off-Base Groundwater Operable Unit - Remedial Investigation: Final. March.

Radian Corporation (Radian). 1985. Installation Restoration Program, Phase II - Confirmation/ Quantification, State 1, Final Report. September.

U.S. Department of Labor. 1987. Distribution of workers by years of tenure with current employer. Bulletin dated Thursday, October 22, 1987. Document USDL 87-452.

U.S. Environmental Protection Agency (USEPA). 1988. Federal Facilities Agreement Under CERCLA Section 120, In the Matter of: U.S. Environmental Protection Agency and Tinker Air Force Base, Oklahoma. Administrative Docket Number: NPL-U3-2-27. December 9.

U.S. Environmental Protection Agency (USEPA). 1989a. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual, Part A. Interim Final (RAGS). EPA/540/1-89/002.

U.S. Environmental Protection Agency (USEPA). 1989b. Exposure Factors Handbook. May.

U.S. Environmental Protection Agency (USEPA). 1990. National Oil and Hazardous Substances Pollution Contingency Plan. Code of Federal Regulations, Chapter 40, Part 300.

U.S. Environmental Protection Agency (USEPA). 1991a. Standard Default Exposure Factors. OSWER Directive 9285.6-03. March

U.S. Environmental Protection Agency (USEPA). 1991b. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation, Part B, Development of Risk-based Preliminary Remediation Goals. EPA/540/R-92/003. December.

U.S. Environmental Protection Agency (USEPA). 1991c. Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions. OSWER Directive 9355.0-30. April 22.

U.S. Environmental Protection Agency (USEPA). 1991d. Supplemental Region IV Risk Assessment Guidance. March 26.

U.S. Environmental Protection Agency (USEPA). 1992a. Dermal Exposure Assessment: Principles and Applications. EPA/600/8-91/011B. January.

U.S. Environmental Protection Agency (USEPA). 1992b. Supplemental Region IV Risk Assessment Guidance. February 11.

U.S. Environmental Protection Agency (USEPA). 1992c. Supplemental Guidance to RAGS: Calculating the Concentration Term. OSWER Directive 9285.7-080. May.

U.S. Environmental Protection Agency (USEPA). 1994. Health Effects Assessment Summary Tables, FY-1994.

U.S. Environmental Protection Agency (USEPA). 1997a. Integrated Risk Information System (IRIS) on-line database.

U.S. Environmental Protection Agency (USEPA). 1997b. Region III Risk-based Concentration Table.

Woodward-Clyde Federal Services (WCFS). 1994. Final Work Plans for Long-Term Monitoring and Ecological Assessment of Soldier Creek Tinker Air Force Base. Report for Tinker Air Force Base, Oklahoma City, Oklahoma. June.

Woodward-Clyde Federal Services (WCFS). 1996. Draft Human Health Risk Assessment Report. Report for Tinker Air Force Base, Oklahoma City, Oklahoma. January.

Woodward-Clyde Federal Services (WCFS). 1997a. Draft Ecological Assessment Report. Report for Tinker Air Force Base, Oklahoma City, Oklahoma. November.

Woodward-Clyde Federal Services (WCFS). 1997b. Draft Human Health Risk Assessment Report. Report for Tinker Air Force Base, Oklahoma City, Oklahoma. February.

ATTACHMENTS

ATTACHMENT A
RISK CALCULATIONS

AREA 1
ON-BASE WEST SOLDIER CREEK

TABLE A-1

TINKER AFB SITE - ON-BASE WEST SOLDIER CREEK (AREA 1)
INGESTION EXPOSURE TO CHEMICALS IN SURFACE WATER
ON-BASE CONSTRUCTION WORKER - AVERAGE EXPOSURE
(CURRENT AND FUTURE USE SCENARIO)

Equation : CDI = (CW X IR X ET X EF X ED)/ (BW X AT1 X AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CW = Concentration in Surface Water
IR = Ingestion Rate = 0.0025 L/hour
ET = Exposure Time = 4 hours per day
EF = Exposure Frequency = 1 day per year
ED = Exposure Duration = 5 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Averaging Time (70 years for cancer causing effects, 5 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Antimony	3.90E-04	1.53E-10	4.00E-04	3.82E-07	1.09E-11		
Arsenic	3.80E-03	1.49E-09	3.00E-04	4.96E-06	1.06E-10	1.50E+00	1.59E-10
Cadmium	3.70E-04	1.45E-10	5.00E-04	2.90E-07	1.03E-11		
Cobalt	9.90E-04	3.87E-10	6.00E-02	6.46E-09	2.77E-11		
Nickel	2.20E-02	8.61E-09	2.00E-02	4.31E-07	6.15E-10		
Vanadium	2.20E-03	8.61E-10	7.00E-03	1.23E-07	6.15E-11		
Semivolatile Organics							
bis(2-Ethylhexyl)phthalate	4.30E-03	1.68E-09	2.00E-02	8.41E-08	1.20E-10	1.40E-02	1.68E-12
Volatile Organics							
Acetone	3.70E-03	1.45E-09	1.00E-01	1.45E-08	1.03E-10		
Chloromethane	1.10E-03	4.31E-10			3.08E-11	1.30E-02	4.00E-13
Styrene	2.80E-03	1.10E-09	2.00E-01	5.48E-09	7.83E-11		
			HAZARD INDEX =	6.29E-06	TOTAL CANCER RISK =		1.61E-10

TABLE A-2

TINKER AFB SITE - ON-BASE WEST SOLDIER CREEK (AREA 1)
INGESTION EXPOSURE TO CHEMICALS IN SURFACE WATER
ON-BASE CONSTRUCTION WORKER - RME
(CURRENT AND FUTURE USE SCENARIO)

Equation : CDI = (CW X IR X ET X EF X ED)/ (BW X AT1 X AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CW = Concentration in Surface Water
IR = Ingestion Rate = 0.005 L/hour
ET = Exposure Time = 8 hours/day
EF = Exposure Frequency = 5 days per year
ED = Exposure Duration = 25 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Averaging Time (70 years for cancer causing effects, 25 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Antimony	5.50E-04	4.31E-09	4.00E-04	1.08E-05	1.54E-09		
Arsenic	3.80E-03	2.97E-08	3.00E-04	9.92E-05	1.06E-08	1.50E+00	1.59E-08
Cadmium	8.80E-04	6.89E-09	5.00E-04	1.38E-05	2.46E-09		
Cobalt	1.80E-03	1.41E-08	6.00E-02	2.35E-07	5.03E-09		
Nickel	5.20E-02	4.07E-07	2.00E-02	2.04E-05	1.45E-07		
Vanadium	4.90E-03	3.84E-08	7.00E-03	5.48E-06	1.37E-08		
Semivolatile Organics							
bis(2-Ethylhexyl)phthalate	4.30E-03	3.37E-08	2.00E-02	1.68E-06	1.20E-08	1.40E-02	1.68E-10
Volatile Organics							
Acetone	3.70E-03	2.90E-08	1.00E-01	2.90E-07	1.03E-08		
Chloromethane	1.10E-03	8.61E-09			3.08E-09	1.30E-02	4.00E-11
Styrene	3.40E-03	2.66E-08	2.00E-01	1.33E-07	9.51E-09		
			HAZARD INDEX =	1.52E-04	TOTAL CANCER RISK =		1.61E-08

TABLE A-3

TINKER AFB SITE - ON-BASE WEST SOLDIER CREEK (AREA 1)
DERMAL EXPOSURE TO CHEMICALS IN SURFACE WATER
ON-BASE CONSTRUCTION WORKER - AVERAGE EXPOSURE
(CURRENT AND FUTURE USE SCENARIOS)

Equation : CDI = (CW x SA x PC x ET x EF x ED x CF)/(BW x AT1 x AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CW = Concentration in Surface Water
SA = Skin Surface Area Available for Contact = 2,000 cm^2
PC = Chemical-specific Dermal Permeability Constant
ET = Exposure Time = 4 hours per day
EF = Exposure Frequency = 1 day per year
ED = Exposure Duration = 5 years
CF = Volumetric Conversion Factor for Water = 0.001 L/cm^3
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Averaging Time (70 years for cancer causing effects, 5 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	PC[a] (cm/hr)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals								
Antimony	3.90E-04	1.00E-03	1.22E-10	4.00E-04	3.05E-07	8.72E-12		
Arsenic	3.80E-03	1.00E-03	1.19E-09	3.00E-04	3.97E-06	8.50E-11	1.50E+00	1.27E-10
Cadmium	3.70E-04	1.00E-03	1.16E-10	5.00E-04	2.32E-07	8.28E-12		
Cobalt	9.90E-04	1.00E-03	3.10E-10	6.00E-02	5.17E-09	2.21E-11		
Nickel	2.20E-02	1.00E-03	6.89E-09	2.00E-02	3.44E-07	4.92E-10		
Vanadium	2.20E-03	1.00E-03	6.89E-10	7.00E-03	9.84E-08	4.92E-11		
Semivolatile Organics								
bis(2-Ethylhexyl)phthalate	4.30E-03	3.20E-02	4.31E-08	2.00E-02	2.15E-06	3.08E-09	1.40E-02	4.31E-11
Volatile Organics								
Acetone	3.70E-03							
Chloromethane	1.10E-03							
Styrene	2.80E-03							
				HAZARD INDEX =	7.11E-06	TOTAL CANCER RISK =		1.71E-10

Note
a Due to the volatility, volatile organics are assumed not available for dermal absorption

TABLE A-4

TINKER AFB SITE - ON-BASE WEST SOLDIER CREEK (AREA 1)
DERMAL EXPOSURE TO CHEMICALS IN SURFACE WATER
ON-BASE CONSTRUCTION WORKER - RME
(CURRENT AND FUTURE USE SCENARIOS)

Equation : CDI = (CW x SA x PC x ET x EF x ED x CF)/(BW x AT1 x AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CW = Concentration in Surface Water
SA = Skin Surface Area Available for Contact = 9,800 cm^2
PC = Chemical-specific Dermal Permeability Constant
ET = Exposure Time = 8 hours per day
EF = Exposure Frequency = 5 days per year
ED = Exposure Duration = 25 years
CF = Volumetric Conversion Factor for Water = 0.001 L/cm^3
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Averaging Time (70 years for cancer causing effects, 25 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	PC[a] (cm/hr)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals								
Antimony	5.50E-04	1.00E-03	8.44E-09	4.00E-04	2.11E-05	3.01E-09		
Arsenic	3.80E-03	1.00E-03	5.83E-08	3.00E-04	1.94E-04	2.08E-08	1.50E+00	3.12E-08
Cadmium	8.80E-04	1.00E-03	1.35E-08	5.00E-04	2.70E-05	4.82E-09		
Cobalt	1.80E-03	1.00E-03	2.76E-08	6.00E-02	4.60E-07	9.86E-09		
Nickel	5.20E-02	1.00E-03	7.98E-07	2.00E-02	3.99E-05	2.85E-07		
Vanadium	4.90E-03	1.00E-03	7.52E-08	7.00E-03	1.07E-05	2.68E-08		
Semivolatile Organics								
bis(2-Ethylhexyl)phthalate	4.30E-03	3.20E-02	2.11E-06	2.00E-02	1.06E-04	7.54E-07	1.40E-02	1.06E-08
Volatile Organics								
Acetone	3.70E-03							
Chloromethane	1.10E-03							
Styrene	3.40E-03							
				HAZARD INDEX =	3.99E-04	TOTAL CANCER RISK =		4.18E-08

Note
a Due to the volatility, volatile organics are assumed not available for dermal absorption.

TABLE A-5

TINKER AFB SITE - ON-BASE WEST SOLDIER CREEK (AREA 1)
DERMAL EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER - AVERAGE EXPOSURE
(CURRENT USE SCENARIO)

Equation: CDI = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT1 x AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CS = Concentration in Sediments
CF = Conversion Factor (10^{-6} kg/mg)
SA = Skin Surface Area Available for Contact = 2,000 cm^2
AF = Dermal Soil Adherence Factor = 0.2 mg/cm^2
ABS = Absorption Factor = 1.0% for organics and 0.1% for inorganics
EF = Exposure Frequency = 1 day per year
ED = Exposure Duration = 5 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Averaging Time (70 years for cancer causing effects, 5 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Beryllium	8.50E-01	1.33E-11	5.00E-03	2.66E-09	9.51E-13	4.30E+00	4.09E-12
Cadmium	1.60E+01	2.50E-10	1.00E-03	2.50E-07	1.79E-11		
Cobalt	1.90E+01	2.97E-10	6.00E-02	4.96E-09	2.12E-11		
Lead	8.30E+01	1.30E-09	NTF		9.28E-11	NTF	
Mercury	1.30E-01	2.04E-12	3.00E-04	6.78E-09	1.45E-13		
Nickel	3.56E+02	5.57E-09	2.00E-02	2.79E-07	3.98E-10		
Silver	2.30E+01	3.60E-10	5.00E-03	7.20E-08	2.57E-11		
Thallium	1.12E+02	1.75E-09	8.00E-05	2.19E-05	1.25E-10		
Vanadium	3.90E+01	6.11E-10	7.00E-03	8.72E-08	4.36E-11		
PCBs/Pesticides							
4,4'-DDE	7.40E-03	1.16E-12			8.28E-14	3.41E-01	2.82E-14
Aldrin	3.70E-03	5.79E-13	3.00E-05	1.93E-08	4.14E-14	1.70E+01	7.03E-13
Aroclor 1254	6.90E-01	1.08E-10	2.00E-05	5.40E-06	7.72E-12	1.00E+00	7.72E-12
Heptachlor epoxide	2.80E-03	4.38E-13	1.30E-05	3.37E-08	3.13E-14	9.10E+00	2.85E-13
Semivolatile Organics							
Anthracene	6.10E-02	9.55E-12	3.00E-01	3.18E-11	6.82E-13		
Benzo(a)anthracene	4.60E-01	7.20E-11			5.14E-12	7.30E-01	3.76E-12
Benzo(a)pyrene	8.40E-01	1.32E-10			9.39E-12	7.30E+00	6.86E-11
Benzo(b)fluoranthene	7.80E-01	1.22E-10			8.72E-12	7.30E-01	6.37E-12
Benzo(g,h,i)perylene	7.50E-01	1.17E-10	3.00E-02	3.91E-09	8.39E-12		
Benzo(k)fluoranthene	8.20E-01	1.28E-10			9.17E-12	7.30E-02	6.69E-13
Chrysene	5.80E-01	9.08E-11			6.49E-12	7.30E-03	4.73E-14
Di-n-butyl phthalate	2.00E-01	3.13E-11	1.00E-01	3.13E-10	2.24E-12		
Dibenz(a,h)anthracene	3.60E-01	5.64E-11			4.03E-12	7.30E+00	2.94E-11
Fluoranthene	8.20E-01	1.28E-10	4.00E-02	3.21E-09	9.17E-12		
Indeno(1,2,3-cd)pyrene	7.00E-01	1.10E-10			7.83E-12	7.30E-01	5.71E-12
Phenanthrene	4.80E-01	7.51E-11	3.00E-02	2.50E-09	5.37E-12		
Pyrene	7.00E-01	1.10E-10	3.00E-02	3.65E-09	7.83E-12		
bis(2-Ethylhexyl)phthalate	1.40E-01	2.19E-11	2.00E-02	1.10E-09	1.57E-12	1.40E-02	2.19E-14
Volatile Organics							
Acetone	1.80E+02	2.82E-12	1.00E-01	2.82E-11	2.01E-13		
Carbon disulfide	5.70E-03	8.92E-13	1.00E-01	8.92E-12	6.37E-14		
Chloromethane	4.00E-03	6.26E-13			4.47E-14	1.30E-02	5.81E-16
Ethylbenzene	4.50E-03	7.05E-13	1.00E-01	7.05E-12	5.03E-14		
Methylene chloride	1.40E-03	2.19E-13	6.00E-02	3.65E-12	1.57E-14	7.50E-03	1.17E-16
Styrene	5.30E-02	8.30E-12	2.00E-01	4.15E-11	5.93E-13		
Toluene	9.40E-03	1.47E-12	2.00E-01	7.36E-12	1.05E-13		
Vinyl chloride	2.80E-03	4.38E-13			3.13E-14	1.90E+00	5.95E-14

HAZARD INDEX = 2.81E-05 TOTAL CANCER RISK = 1.27E-10

NTF = No critical toxicity values. Surrogate toxicity values are not available for these chemicals. Therefore, they were not evaluated in the quantitative risk assessment.

TABLE A-6

TINKER AFB SITE - ON-BASE WEST SOLDIER CREEK (AREA 1)
DERMAL EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER - RME
(CURRENT USE SCENARIO)

Equation CDI = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT1 x AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CS = Concentration in Sediments
CF = Conversion Factor (10^{-6} kg/mg)
SA = Skin Surface Area Available for Contact = 9,800 cm^2
AF = Dermal Soil Adherence Factor = 1.0 mg/cm^2
ABS = Absorption Factor = 1.0% for organics and 0.1% for inorganics
EF = Exposure Frequency = 5 days per year
ED = Exposure Duration = 25 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Averaging Time (70 years for cancer causing effects, 25 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Beryllium	1.20E+00	2.30E-09	5.00E-03	4.60E-07	8.22E-10	4.30E+00	3.53E-09
Cadmium	8.00E+01	1.53E-07	1.00E-03	1.53E-04	5.48E-08		
Cobalt	4.50E+01	8.63E-08	6.00E-02	1.44E-06	3.08E-08		
Lead	2.80E+02	5.37E-07	NTF		1.92E-07	NTF	
Mercury	3.80E-01	7.29E-10	3.00E-04	2.43E-06	2.60E-10		
Nickel	1.43E+03	2.74E-06	2.00E-02	1.37E-04	9.79E-07		
Silver	9.90E+01	1.90E-07	5.00E-03	3.80E-05	6.78E-08		
Thallium	1.27E+02	2.44E-07	8.00E-05	3.04E-03	8.70E-08		
Vanadium	5.60E+01	1.07E-07	7.00E-03	1.53E-05	3.84E-08		
PCBs/Pesticides							
4,4'-DDE	8.50E-03	1.63E-10			5.82E-11	3.41E-01	1.99E-11
Aldrin	6.70E-03	1.28E-10	3.00E-05	4.28E-06	4.59E-11	1.70E+01	7.80E-10
Aroclor 1254	4.40E+00	8.44E-08	2.00E-05	4.22E-03	3.01E-08	2.00E+00	6.03E-08
Heptachlor epoxide	2.80E-03	5.37E-11	1.30E-05	4.13E-06	1.92E-11	9.10E+00	1.75E-10
Semivolatile Organics							
Anthracene	6.10E-02	1.17E-09	3.00E-01	3.90E-09	4.18E-10		
Benzo(a)anthracene	1.90E+00	3.64E-08			1.30E-08	7.30E-01	9.50E-09
Benzo(a)pyrene	5.20E+00	9.97E-08			3.56E-08	7.30E+00	2.60E-07
Benzo(b)fluoranthene	4.20E+00	8.05E-08			2.88E-08	7.30E-01	2.10E-08
Benzo(g,h,i)perylene	3.70E+00	7.10E-08	3.00E-02	2.37E-06	2.53E-08		
Benzo(k)fluoranthene	4.10E+00	7.86E-08			2.81E-08	7.30E-02	2.05E-09
Chrysene	2.50E+00	4.79E-08			1.71E-08	7.30E-03	1.25E-10
Di-n-butyl phthalate	2.00E-01	3.84E-09	1.00E-01	3.84E-08	1.37E-09		
Dibenz(a,h)anthracene	6.80E-01	1.30E-08			4.66E-09	7.30E+00	3.40E-08
Fluoranthene	3.40E+00	6.52E-08	4.00E-02	1.63E-06	2.33E-08		
Indeno(1,2,3-cd)pyrene	2.50E+00	4.79E-08			1.71E-08	7.30E-01	1.25E-08
Phenanthrene	2.30E+00	4.41E-08	3.00E-02	1.47E-06	1.58E-08		
Pyrene	2.80E+00	5.37E-08	3.00E-02	1.79E-06	1.92E-08		
bis(2-Ethylhexyl)phthalate	1.40E-01	2.68E-09	2.00E-02	1.34E-07	9.59E-10	1.40E-02	1.34E-11
Volatile Organics							
Acetone	4.70E-02	9.01E-10	1.00E-01	9.01E-09	3.22E-10		
Carbon disulfide	5.70E-03	1.09E-10	1.00E-01	1.09E-09	3.90E-11		
Chloromethane	4.00E-03	7.67E-11			2.74E-11	1.30E-02	3.56E-13
Ethylbenzene	4.50E-03	8.63E-11	1.00E-01	8.63E-10	3.08E-11		
Methylene chloride	1.40E-03	2.68E-11	6.00E-02	4.47E-10	9.59E-12	7.50E-03	7.19E-14
Styrene	2.30E-01	4.41E-09	2.00E-01	2.21E-08	1.58E-09		
Toluene	2.50E-02	4.79E-10	2.00E-01	2.40E-09	1.71E-10		
Vinyl chloride	2.80E-03	5.37E-11			1.92E-11	1.90E+00	3.64E-11
			HAZARD INDEX	7.56E-03	TOTAL CANCER RISK =		4.04E-07

NTF = No critical toxicity values. Surrogate toxicity values are not available for these chemicals; therefore, they were not evaluated in the quantitative risk assessment.

TABLE A-7

TINKER AFB SITE - ON-BASE WEST SOLDIER CREEK (AREA 1)
INGESTION EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER - AVERAGE EXPOSURE
(CURRENT USE SCENARIO)

Equation: CDI = (CS x CF x IR x EF x ED)/(BW x AT1 x AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CS = Concentration in Sediments
CF = Conversion Factor (10^{-6} kg/mg)
IR = Sediment Ingestion Rate = 10 mg/day
EF = Exposure Frequency = 1 day per year
ED = Exposure Duration = 5 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Average Time (70 years for cancer causing effects, 5 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Beryllium	8.50E-01	3.33E-10	5.00E-03	6.65E-08	2.38E-11	4.30E+00	1.02E-10
Cadmium	1.60E+01	6.26E-09	1.00E-03	6.26E-06	4.47E-10		
Cobalt	1.90E+01	7.44E-09	6.00E-02	1.24E-07	5.31E-10		
Lead	8.30E+01	3.25E-08	NTF		2.32E-09	NTF	
Mercury	1.30E-01	5.09E-11	3.00E-04	1.70E-07	3.63E-12		
Nickel	3.56E+02	1.39E-07	2.00E-02	6.97E-06	9.95E-09		
Silver	2.30E+01	9.00E-09	5.00E-03	1.80E-06	6.43E-10		
Thallium	1.12E+02	4.38E-08	8.00E-05	5.48E-04	3.13E-09		
Vanadium	3.90E+01	1.53E-08	7.00E-03	2.18E-06	1.09E-09		
PCBs/Pesticides							
4,4'-DDE	7.40E-03	2.90E-12			2.07E-13	3.41E-01	7.05E-14
Aldrin	3.70E-03	1.45E-12	3.00E-05	4.83E-08	1.03E-13	1.70E+01	1.76E-12
Aroclor 1254	6.90E-01	2.70E-10	2.00E-05	1.35E-05	1.93E-11	1.00E+00	1.93E-11
Heptachlor epoxide	2.80E-03	1.10E-12	1.30E-05	8.43E-08	7.83E-14	9.10E+00	7.12E-13
Semivolatile Organics							
Anthracene	6.10E-02	2.39E-11	3.00E-01	7.96E-11	1.71E-12		
Benzo(a)anthracene	4.60E-01	1.80E-10			1.29E-11	7.30E-01	9.39E-12
Benzo(a)pyrene	8.40E-01	3.29E-10			2.35E-11	7.30E+00	1.71E-10
Benzo(b)fluoranthene	7.80E-01	3.05E-10			2.18E-11	7.30E-01	1.59E-11
Benzo(g,h,i)perylene	7.50E-01	2.94E-10	3.00E-02	9.78E-09	2.10E-11		
Benzo(k)fluoranthene	8.20E-01	3.21E-10			2.29E-11	7.30E-02	1.67E-12
Chrysene	5.80E-01	2.27E-10			1.62E-11	7.30E-03	1.18E-13
Di-n-butyl phthalate	2.00E-01	7.83E-11	1.00E-01	7.83E-10	5.59E-12		
Dibenz(a,h)anthracene	3.60E-01	1.41E-10			1.01E-11	7.30E+00	7.35E-11
Fluoranthene	8.20E-01	3.21E-10	4.00E-02	8.02E-09	2.29E-11		
Indeno(1,2,3-cd)pyrene	7.00E-01	2.74E-10			1.96E-11	7.30E-01	1.43E-11
Phenanthrene	4.80E-01	1.88E-10	3.00E-02	6.26E-09	1.34E-11		
Pyrene	7.00E-01	2.74E-10	3.00E-02	9.13E-09	1.96E-11		
bis(2-Ethylhexyl)phthalate	1.40E-01	5.48E-11	2.00E-02	2.74E-09	3.91E-12	1.40E-02	5.48E-14
Volatile Organics							
Acetone	1.80E-02	7.05E-12	1.00E-01	7.05E-11	5.03E-13		
Carbon disulfide	5.70E-03	2.23E-12	1.00E-01	2.23E-11	1.59E-13		
Chloromethane	4.00E-03	1.57E-12			1.12E-13	1.30E-02	1.45E-15
Ethylbenzene	4.50E-03	1.76E-12	1.00E-01	1.76E-11	1.26E-13		
Methylene chloride	1.40E-03	5.48E-13	6.00E-02	9.13E-12	3.91E-14	7.50E-03	2.94E-16
Styrene	5.30E-02	2.07E-11	2.00E-01	1.04E-10	1.48E-12		
Toluene	9.40E-03	3.68E-12	2.00E-01	1.84E-11	2.63E-13		
Vinyl chloride	2.80E-03	1.10E-12			7.83E-14	1.90E+00	1.49E-13
			HAZARD INDEX	5.79E-04		TOTAL CANCER RISK =	4.10E-10

NTF = No critical toxicity values. Surrogate toxicity values are not available for these chemicals, therefore, they were not evaluated in the quantitative risk assessment.

TABLE A-8

TINKER AFB SITE - ON-BASE WEST SOLDIER CREEK (AREA 1)
INGESTION EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER - RME
(CURRENT USE SCENARIO)

Equation: CDI = (CS x CF x IR x EF x ED)/(BW x AT1 x AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CS = Concentration in Sediments
CF = Conversion Factor (10^{-6} kg/mg)
IR = Sediment Ingestion Rate = 50 mg/day
EF = Exposure Frequency = 5 days per year
ED = Exposure Duration = 25 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Average Time (70 years for cancer causing effects, 25 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Beryllium	1.20E+00	1.17E-08	5.00E-03	2.35E-06	4.19E-09	4.30E+00	1.80E-08
Cadmium	8.00E+01	7.83E-07	1.00E-03	7.83E-04	2.80E-07		
Cobalt	4.50E+01	4.40E-07	6.00E-02	7.34E-06	1.57E-07		
Lead	2.80E+02	2.74E-06	NTF		9.78E-07	NTF	
Mercury	3.80E-01	3.72E-09	3.00E-04	1.24E-05	1.33E-09		
Nickel	1.43E+03	1.40E-05	2.00E-02	7.00E-04	5.00E-06		
Silver	9.90E+01	9.69E-07	5.00E-03	1.94E-04	3.46E-07		
Thallium	1.27E+02	1.24E-06	8.00E-05	1.55E-02	4.44E-07		
Vanadium	5.60E+01	5.48E-07	7.00E-03	7.83E-05	1.96E-07		
PCBs/Pesticides							
4,4'-DDE	8.50E-03	8.32E-11			2.97E-11	3.41E-01	1.01E-11
Aldrin	6.70E-03	6.56E-11	3.00E-05	2.19E-06	2.34E-11	1.70E+01	3.98E-10
Aroclor 1254	4.40E+00	4.31E-08	2.00E-05	2.15E-03	1.54E-08	2.00E+00	3.08E-08
Heptachlor epoxide	2.80E-03	2.74E-11	1.30E-05	2.11E-06	9.78E-12	9.10E+00	8.90E-11
Semivolatile organics							
Anthracene	6.10E-02	5.97E-10	3.00E-01	1.99E-09	2.13E-10		
Benzo(a)anthracene	1.90E+00	1.86E-08			6.64E-09	7.30E-01	4.85E-09
Benzo(a)pyrene	5.20E+00	5.09E-08			1.82E-08	7.30E+00	1.33E-07
Benzo(b)fluoranthene	4.20E+00	4.11E-08			1.47E-08	7.30E-01	1.07E-08
Benzo(g,h,i)perylene	3.70E+00	3.62E-08	3.00E-02	1.21E-06	1.29E-08		
Benzo(k)fluoranthene	4.10E+00	4.01E-08			1.43E-08	7.30E-02	1.05E-09
Chrysene	2.50E+00	2.45E-08			8.74E-09	7.30E-03	6.38E-11
Di-n-butyl phthalate	2.00E-01	1.96E-09	1.00E-01	1.96E-08	6.99E-10		
Dibenz(a,h)anthracene	6.80E-01	6.65E-09			2.38E-09	7.30E+00	1.73E-08
Fluoranthene	3.40E+00	3.33E-08	4.00E-02	8.32E-07	1.19E-08		
Indeno(1,2,3-cd)pyrene	2.50E+00	2.45E-08			8.74E-09	7.30E-01	6.38E-09
Phenanthrene	2.30E+00	2.25E-08	3.00E-02	7.50E-07	8.04E-09		
Pyrene	2.80E+00	2.74E-08	3.00E-02	9.13E-07	9.78E-09		
bis(2-Ethylhexyl)phthalate	1.40E-01	1.37E-09	2.00E-02	6.85E-08	4.89E-10	1.40E-02	6.85E-12
Volatile Organics							
Acetone	4.70E-02	4.60E-10	1.00E-01	4.60E-09	1.64E-10		
Carbon disulfide	5.70E-03	5.58E-11	1.00E-01	5.58E-10	1.99E-11		
Chloromethane	4.00E-03	3.91E-11			1.40E-11	1.30E-02	1.82E-13
Ethylbenzene	4.50E-03	4.40E-11	1.00E-01	4.40E-10	1.57E-11		
Methylene chloride	1.40E-03	1.37E-11	6.00E-02	2.28E-10	4.89E-12	7.50E-03	3.67E-14
Styrene	2.30E-01	2.25E-09	2.00E-01	1.13E-08	8.04E-10		
Toluene	2.50E-02	2.45E-10	2.00E-01	1.22E-09	8.74E-11		
Vinyl chloride	2.80E-03	2.74E-11			9.78E-12	1.40E+00	1.86E-11
			HAZARD INDEX =	1.05E-02		TOTAL CANCER RISK =	2.22E-07

NTF = No critical toxicity values. Surrogate toxicity values are not available for these chemicals. Therefore, they were not evaluated in the quantitative risk assessment.

TABLE A-9

TINKER AFB SITE - ON-BASE WEST SOLDIER CREEK (AREA 1)
DERMAL EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER -AVERAGE EXPOSURE
(FUTURE USE SCENARIO)

Equation CDI = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT1 x AT2)

Hazard Quotient = CDI / RfD

Cancer Risk = CDI x Slope Factor

Where:

CDI = Chronic Daily Intake

CS = Concentration in Sediments

CF = Conversion Factor (10^{-6} kg/mg)

SA = Skin Surface Area Available for Contact = 2,000 cm^2

AF = Dermal Soil Adherence Factor = 0.2 mg/cm^2

ABS = Absorption Factor = 1.0% for organics and 0.1% for inorganics

EF = Exposure Frequency = 1 day per year

ED = Exposure Duration = 5 years

BW = Body Weight = 70 kg

AT1 = Days Per Year = 365 days

AT2 = Averaging Time (70 years for cancer causing effects,
5 years for effects other than carcinogenic)

SF = Slope Factor

RfD = Reference Dose

CONTAMINANTS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Antimony	4.50E+00	7.05E-11	4.00E-04	1.76E-07	5.03E-12		
Beryllium	7.40E-01	1.16E-11	5.00E-03	2.32E-09	8.28E-13	4.30E+00	3.56E-12
Cadmium	2.20E+01	3.44E-10	1.00E-03	3.44E-07	2.46E-11		
Chromium	3.20E+02	5.01E-09	5.00E-03	1.00E-06	3.58E-10		
Cobalt	2.40E+01	3.76E-10	6.00E-02	6.26E-09	2.68E-11		
Lead	9.40E+01		NTF			NTF	
Mercury	1.00E-01	1.57E-12	3.00E-04	5.22E-09	1.12E-13		
Nickel	4.40E+02	6.89E-09	2.00E-02	3.44E-07	4.92E-10		
Silver	4.00E+01	6.26E-10	5.00E-03	1.25E-07	4.47E-11		
Thallium	9.60E+01	1.50E-09	8.00E-05	1.88E-05	1.07E-10		
Vanadium	3.80E+01	5.95E-10	7.00E-03	8.50E-08	4.25E-11		
PCBs/Pesticides							
Aldrin	6.70E-03	1.05E-12	3.00E-05	3.50E-08	7.49E-14	1.70E+01	1.27E-12
Aroclor 1254	4.20E+00	6.58E-10	2.00E-05	3.29E-05	4.70E-11	1.00E+00	4.70E-11
Semivolatile Organics							
1,2-Dichlorobenzene	5.60E-01	8.77E-11	9.00E-02	9.74E-10	6.26E-12		
2-Methylnaphthalene	5.00E-01	7.83E-11	3.00E-02	2.61E-09	5.59E-12		
Acenaphthene	5.20E-01	8.14E-11	6.00E-02	1.36E-09	5.81E-12		
Anthracene	5.40E-01	8.45E-11	3.00E-01	2.82E-10	6.04E-12		
Benzidine	2.20E-01	3.44E-11	3.00E-03	1.15E-08	2.46E-12	2.30E+02	5.66E-10
Benzo(a)anthracene	7.30E-01	1.14E-10			8.16E-12	7.30E-01	5.96E-12
Benzo(a)pyrene	8.70E-01	1.36E-10			9.73E-12	7.30E+00	7.10E-11
Benzo(b)fluoranthene	8.90E-01	1.39E-10			9.95E-12	7.30E-01	7.27E-12
Benzo(g,h,i)perylene	5.80E-01	9.08E-11	3.00E-02	3.03E-09	6.49E-12		
Benzo(k)fluoranthene	1.10E+00	1.72E-10			1.23E-11	7.30E-02	8.98E-13
Chrysene	9.00E-01	1.41E-10			1.01E-11	7.30E-03	7.35E-14
Dibenz(a,h)anthracene	3.90E-01	6.11E-11			4.36E-12	7.30E+00	3.18E-11
Dibenzofuran	5.20E-01	8.14E-11	4.00E-03	2.04E-08	5.81E-12		
Fluoranthene	1.80E+00	2.82E-10	4.00E-02	7.05E-09	2.01E-11		
Fluorene	5.40E-01	8.45E-11	4.00E-02	2.11E-09	6.04E-12		
Indeno(1,2,3-cd)pyrene	5.60E-01	8.77E-11			9.26E-12	7.30E-01	4.57E-12
Naphthalene	5.90E-01	9.24E-11	3.00E-02	3.08E-09	6.60E-12		
Phenanthrene	1.30E+00	2.04E-10	3.00E-02	6.78E-09	1.45E-11		
Pyrene	1.40E+00	2.19E-10	3.00E-02	7.31E-09	1.57E-11		
bis(2-Ethylhexyl)phthalate	1.40E-01	2.19E-11	2.00E-02	1.10E-09	1.57E-12	1.40E-02	2.19E-14
Volatile Organics							
Acetone	1.40E-02	2.19E-12	1.00E-01	2.19E-11	1.57E-13		
Ethylbenzene	6.40E-03	1.00E-12	1.00E-01	1.00E-11	7.16E-14		
Methylene chloride	1.80E-03	2.82E-13	6.00E-02	4.70E-12	2.01E-14	7.50E-03	5.51E-16
Styrene	2.60E-02	4.07E-12	2.00E-01	2.04E-11	2.91E-13		
Toluene	6.70E-03	1.05E-12	2.00E-01	5.24E-12	7.49E-14		
			HAZARD INDEX =	5.39E-05	TOTAL CANCER RISK =		7.39E-10

NTF = No critical toxicity values. Surrogate toxicity values are not available for these chemicals; therefore, they were not evaluated in the quantitative risk assessment.

TABLE A-10

TINKER AFB SITE - ON-BASE WEST SOLDIER CREEK (AREA 1)
DERMAL EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER - RME
(FUTURE USE SCENARIO)

Equation: CDI = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT1 x AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CS = Concentration in Sediments
CF = Conversion Factor (10^{-6} kg/mg)
SA = Skin Surface Area Available for Contact = 9,800 cm^2
AF = Dermal Soil Adherence Factor = 1.0 mg/cm^2
ABS = Absorption Factor = 1.0% for organics and 0.1% for inorganics
EF = Exposure Frequency = 5 days per year
ED = Exposure Duration = 25 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Averaging Time (70 years for cancer causing effects, 25 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Antimony	5.00E+00	9.59E-09	4.00E-04	2.40E-05	3.42E-09		
Beryllium	9.40E-01	1.80E-09	5.00E-03	3.61E-07	6.44E-10	4.30E+00	2.77E-09
Cadmium	1.60E+02	3.07E-07	1.00E-03	3.07E-04	1.10E-07		
Chromium	8.00E+02	1.53E-06	5.00E-03	3.07E-04	5.48E-07		
Cobalt	3.50E+01	6.71E-08	6.00E-02	1.12E-06	2.40E-08		
Lead	1.90E+02	3.64E-07	NTF		1.30E-07	NTF	
Mercury	1.80E-01	3.45E-10	3.00E-04	1.15E-06	1.23E-10		
Nickel	1.40E+03	2.68E-06	2.00E-02	1.34E-04	9.59E-07		
Silver	1.70E+02	3.26E-07	5.00E-03	6.52E-05	1.16E-07		
Thallium	1.30E+02	2.49E-07	8.00E-05	3.12E-03	8.90E-08		
Vanadium	4.80E+01	9.21E-08	7.00E-03	1.32E-05	3.29E-08		
PCBs/Pesticides							
Aldrin	6.70E-03	1.28E-10	3.00E-05	4.28E-06	4.59E-11	1.70E+01	7.80E-10
Aroclor 1254	3.00E+01	5.75E-07	2.00E-05	2.88E-02	2.05E-07	2.00E+00	4.11E-07
Semivolatile Organics							
1,2-Dichlorobenzene	7.30E-01	1.40E-08	9.00E-02	1.56E-07	5.00E-09		
2-Methylnaphthalene	6.20E-01	1.19E-08	3.00E-02	3.96E-07	4.25E-09		
Acenaphthene	7.20E-01	1.38E-08	6.00E-02	2.30E-07	4.93E-09		
Anthracene	8.40E-01	1.61E-08	3.00E-01	5.37E-08	5.75E-09		
Benzidine	2.20E-01	4.22E-09	3.00E-03	1.41E-06	1.51E-09	2.30E+02	3.47E-07
Benzo(a)anthracene	1.20E+00	2.30E-08			8.22E-09	7.30E-01	6.00E-09
Benzo(a)pyrene	1.50E+00	2.88E-08			1.03E-08	7.30E+00	7.50E-08
Benzo(b)fluoranthene	1.60E+00	3.07E-08			1.10E-08	7.30E-01	8.00E-09
Benzo(g,h,i)perylene	8.30E-01	1.59E-08	3.00E-02	5.31E-07	5.68E-09		
Benzo(k)fluoranthene	1.60E+00	3.04E-08			1.30E-08	7.30E-02	9.50E-10
Chrysene	1.50E+00	2.88E-08			1.03E-08	7.30E-03	7.50E-11
Dibenz(a,h)anthracene	5.10E-01	9.78E-09			3.49E-09	7.30E+00	2.55E-08
Dibenzofuran	6.70E-01	1.28E-08	4.00E-03	3.21E-06	4.59E-09		
Fluoranthene	3.00E+00	5.75E-08	4.00E-02	1.44E-06	2.05E-08		
Fluorene	7.10E-01	1.36E-08	4.00E-02	3.40E-07	4.86E-09		
Indeno(1,2,3-cd)pyrene	7.90E-01	1.52E-08			5.41E-09	7.30E-01	3.95E-09
Naphthalene	7.90E-01	1.52E-08	3.00E-02	5.05E-07	5.41E-09		
Phenanthrene	2.30E+00	4.03E-08	3.00E-02	1.34E-06	1.44E-08		
Pyrene	2.20E+00	4.22E-08	3.00E-02	1.41E-06	1.51E-08		
bis(2-Ethylhexyl)phthalate	1.40E+01	2.68E-07	2.00E-02	1.34E-05	9.59E-10	1.40E-02	1.34E-11
Volatile Organics							
Acetone	1.80E-02	3.45E-10	1.00E-01	3.45E-09	1.23E-10		
Ethylbenzene	7.20E-03	1.38E-10	1.00E-01	1.38E-09	4.93E-11		
Methylene chloride	1.80E-03	3.45E-11	6.00E-02	5.75E-10	1.23E-11	7.50E-03	9.25E-14
Styrene	2.60E-02	4.99E-10	2.00E-01	2.49E-09	1.78E-10		
Toluene	8.40E-03	1.61E-10	2.00E-01	8.05E-10	5.75E-11		
			HAZARD INDEX =	3.28E-02		TOTAL CANCER RISK =	8.81E-07

NTF = No critical toxicity values. Surrogate toxicity values are not available for these chemicals therefore they were not evaluated in the quantitative risk assessment.

TABLE A-11

TINKER AFB SITE - ON-BASE WEST SOLDIER CREEK (AREA 1)
INGESTION EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER - AVERAGE EXPOSURE
(FUTURE USE SCENARIO)

Equation CDI = (CS x CF x IR x EF x ED)/(BW x AT1 x AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CS = Concentration in Sediments
CF = Conversion Factor (10^{-6} kg/mg)
IR = Sediment Ingestion Rate = 10 mg/day
EF = Exposure Frequency = 1 day per year
ED = Exposure Duration = 5 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Average Time (70 years for cancer causing effects, 5 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Antimony	4.50E+00	1.76E-09	4.00E-04	4.40E-06	1.26E-10		
Beryllium	7.40E-01	2.90E-10	5.00E-03	5.79E-08	2.07E-11	4.30E+00	8.90E-11
Cadmium	2.20E+01	8.61E-09	1.00E-03	8.61E-06	6.15E-10		
Chromium	3.20E+02	1.25E-07	5.00E-03	2.50E-05	8.95E-09		
Cobalt	2.40E+01	9.39E-09	6.00E-02	1.57E-07	6.71E-10		
Lead	9.40E+01	3.68E-08	NTF		2.63E-09	NTF	
Mercury	1.00E-01	3.91E-11	3.00E-04	1.30E-07	2.80E-12		
Nickel	4.40E+02	1.72E-07	2.00E-02	8.61E-06	1.23E-08		
Silver	4.00E+01	1.57E-08	5.00E-03	3.13E-06	1.12E-09		
Thallium	9.60E+01	3.76E-08	8.00E-05	4.70E-04	2.68E-09		
Vanadium	3.80E+01	1.49E-08	7.00E-03	2.12E-06	1.06E-09		
PCBs/Pesticides							
Aldrin	6.70E-03	2.62E-12	3.00E-05	8.74E-08	1.87E-13	1.70E+01	3.18E-12
Aroclor 1254	4.20E+00	1.64E-09	2.00E-05	8.22E-05	1.17E-10	1.00E+00	1.17E-10
Semivolatile organics							
1,2-Dichlorobenzene	5.60E-01	2.19E-10	9.00E-02	2.44E-09	1.57E-11		
2-Methylnaphthalene	5.00E-01	1.96E-10	3.00E-02	6.52E-09	1.40E-11		
Acenaphthene	5.20E-01	2.04E-10	6.00E-02	3.39E-09	1.45E-11		
Anthracene	5.40E-01	2.11E-10	3.00E-01	7.05E-10	1.51E-11		
Benzidine	2.20E-01	8.61E-11	3.00E-03	2.87E-08	6.15E-12	2.30E+02	1.41E-09
Benzo(a)anthracene	7.30E-01	2.86E-10			2.04E-11	7.30E-01	1.49E-11
Benzo(a)pyrene	8.70E-01	3.41E-10			2.43E-11	7.30E+00	1.78E-10
Benzo(b)fluoranthene	8.90E-01	3.48E-10			2.49E-11	7.30E-01	1.82E-11
Benzo(g,h,i)perylene	5.80E-01	2.27E-10	3.00E-02	7.57E-09	1.62E-11		
Benzo(k)fluoranthene	1.10E+00	4.31E-10			3.08E-11	7.30E-02	2.24E-12
Chrysene	9.00E-01	3.52E-10			2.52E-11	7.30E-03	1.84E-13
Dibenz(a,h)anthracene	3.90E-01	1.53E-10			1.09E-11	7.30E+00	7.96E-11
Dibenzofuran	5.20E-01	2.04E-10	4.00E-03	5.09E-08	1.45E-11		
Fluoranthene	1.80E+00	7.05E-10	4.00E-02	1.76E-08	5.03E-11		
Fluorene	5.40E-01	2.11E-10	4.00E-02	5.28E-09	1.51E-11		
Indeno(1,2,3-cd)pyrene	5.60E-01	2.19E-10			1.57E-11	7.30E-01	1.14E-11
Naphthalene	5.90E-01	2.31E-10	3.00E-02	7.70E-09	1.65E-11		
Phenanthrene	1.30E+00	5.09E-10	3.00E-02	1.70E-08	3.63E-11		
Pyrene	1.40E+00	5.48E-10	3.00E-02	1.83E-08	3.91E-11		
bis(2-Ethylhexyl)phthalate	1.40E-01	5.48E-11	2.00E-02	2.74E-09	3.91E-12	1.40E-02	5.48E-14
Volatile Organics							
Acetone	1.40E-02	5.48E-12	1.00E-01	5.48E-11	3.91E-13		
Ethylbenzene	3.40E-03	1.33E-12	1.00E-01	1.33E-11	9.50E-14		
Methylene chloride	1.30E-03	5.09E-13	6.00E-02	1.17E-11	9.03E-14	7.50E-03	3.77E-16
Styrene	2.60E-02	1.02E-11	2.00E-01	5.09E-11	7.27E-13		
Toluene	6.70E-03	2.62E-12	2.00E-01	1.31E-11	1.87E-13		
			HAZARD INDEX	9.4E-04		TOTAL CANCER RISK =	1.03E-09

NTF = No critical toxicity values. Surrogate toxicity values are not available for these chemicals; therefore, they were not evaluated in the quantitative risk assessment.

TABLE A-12

TINKER AFB SITE - ON-BASE WEST SOLDIER CREEK (AREA 1)
INGESTION EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER - RME
(FUTURE USE SCENARIO)

Equation: CDI = (CS x CF x IR x EF x ED)/(BW x AT1 x AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CS = Concentration in Sediments
CF = Conversion Factor (10^{-6} kg/mg)
IR = Sediment Ingestion Rate = 50 mg/day
EF = Exposure Frequency = 5 days per year
ED = Exposure Duration = 25 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Average Time (70 years for cancer causing effects, 25 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Antimony	5.00E+00	4.89E-08	4.00E-04	1.22E-04	1.75E-08		
Beryllium	9.40E-01	9.20E-09	5.00E-03	1.84E-06	3.28E-09	4.30E+00	1.41E-08
Cadmium	1.60E+02	1.57E-06	1.00E-03	1.57E-03	5.59E-07		
Chromium	8.00E+02	7.83E-06	5.00E-03	1.57E-03	2.80E-06		
Cobalt	3.50E+01	3.42E-07	6.00E-02	5.71E-06	1.22E-07		
Lead	1.90E+02	1.86E-06	NTF		6.64E-07	NTF	
Mercury	1.80E-01	1.76E-09	3.00E-04	5.87E-06	6.29E-10		
Nickel	1.40E+03	1.37E-05	2.00E-02	6.85E-04	4.89E-06		
Silver	1.70E+02	1.66E-06	5.00E-03	3.33E-04	5.94E-07		
Thallium	1.30E+02	1.27E-06	8.00E-05	1.59E-02	4.54E-07		
Vanadium	4.80E+01	4.70E-07	7.00E-03	6.71E-05	1.68E-07		
PCBs/Pesticides							
Aldrin	6.70E-03	6.56E-11	3.00E-05	2.19E-06	2.34E-11	1.70E+01	3.98E-10
Aroclor 1254	3.00E+01	2.94E-07	2.00E-05	1.47E-02	1.05E-07	1.00E+00	1.05E-07
Semivolatile organics							
1,2-Dichlorobenzene	7.30E-01	7.14E-09	9.00E-02	7.94E-08	2.55E-09		
2-Methylnaphthalene	6.20E-01	6.07E-09	3.00E-02	2.02E-07	2.17E-09		
Acenaphthene	7.20E-01	7.05E-09	6.00E-02	1.17E-07	2.52E-09		
Anthracene	8.40E-01	8.22E-09	3.00E-01	2.74E-08	2.94E-09		
Benzidine	2.20E-01	2.15E-09	3.00E-03	7.18E-07	7.69E-10	2.30E+02	1.77E-07
Benzo(a)anthracene	1.20E+00	1.17E-08			4.19E-09	7.30E-01	3.06E-09
Benzo(a)pyrene	1.50E+00	1.47E-08			5.24E-09	7.30E+00	3.83E-08
Benzo(b)fluoranthene	1.60E+00	1.57E-08			5.59E-09	7.30E-01	4.08E-09
Benzo(g,h,i)perylene	8.30E-01	8.12E-09	3.00E-02	2.71E-07	2.90E-09		
Benzo(k)fluoranthene	1.90E+00	1.86E-08			6.64E-09	7.30E-02	4.85E-10
Chrysene	1.50E+00	1.47E-08			5.24E-09	7.30E-03	3.83E-11
Dibenz(a,h)anthracene	5.10E-01	4.99E-09			1.78E-09	7.30E+00	1.30E-08
Dibenzofuran	6.70E-01	6.56E-09	4.00E-03	1.64E-06	2.34E-09		
Fluoranthene	3.00E+00	2.94E-08	4.00E-02	7.34E-07	1.05E-08		
Fluorene	7.10E-01	6.95E-09	4.00E-02	1.74E-07	2.48E-09		
Indeno(1,2,3-cd)pyrene	7.90E-01	7.73E-09			2.76E-09	7.30E-01	2.02E-09
Naphthalene	7.90E-01	7.73E-09	3.00E-02	2.58E-07	2.76E-09		
Phenanthrene	2.10E+00	2.05E-08	3.00E-02	6.85E-07	7.34E-09		
Pyrene	2.20E+00	2.15E-08	3.00E-02	7.18E-07	7.69E-09		
bis(2-Ethylhexyl)phthalate	1.40E+01	1.37E-09	2.00E-02	6.85E-08	4.89E-10	1.40E-02	6.85E-12
Volatile Organics							
Acetone	1.80E+02	1.76E-09	1.00E-01	1.76E-09	6.29E-13		
Ethylbenzene	7.20E+03	7.05E-11	1.00E-01	7.05E-10	2.52E-11		
Methylene chloride	1.80E+03	1.76E-11	6.00E-02	2.94E-10	6.29E-12	7.50E-03	4.72E-14
Styrene	2.60E+02	2.54E-10	2.00E-01	1.27E-09	9.09E-11		
Toluene	8.40E+03	8.22E-11	2.00E-01	4.11E-10	2.94E-11		
			HAZARD INDEX =	3.19E-02	TOTAL CANCER RISK =		3.57E-07

NTF = No critical toxicity values. Surrogate toxicity values are not available for these chemicals, therefore, they were not evaluated in the quantitative risk assessment.

AREA 2
OFF-BASE WEST SOLDIER CREEK

TABLE A-13

TINKER AFB SITE - OFF-BASE WEST SOLDIER CREEK (AREA 2)
INCIDENTAL INGESTION OF CHEMICALS IN SURFACE WATER DUE TO WADING
OFF-BASE CHILD AND ADULT RESIDENT - AVERAGE EXPOSURE
(CURRENT AND FUTURE USE SCENARIO)

Equation : **HIF = [(IRc x ETc x EFc x EDc) / BWc + (IRa x ETa x EFa x EDa) / BWa] / (AT1 x AT2)**
CDI = CW x HIF
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
HIF = Human Intake Factor
CDI = Chronic Daily Intake
CW = Concentration in Surface Water
IRc = Child Ingestion Rate = 0.0025 L/hour
ETc = Child Exposure Time = 3 hours/day
EFc = Child Exposure Frequency = 17 days per year
EDc = Child Exposure Duration = 5 years
BWc = Child Body Weight = 15.1 kg
IRa = Adult Ingestion Rate = 0.0025 L/hour
ETa = Adult Exposure Time = 1 hour /day
EFa = Adult Exposure Frequency = 2 days per year
EDa = Adult Exposure Duration = 9 years
BW = Adult Body Weight = 57.1 kg
AT1 = Days Per Year = 365 days/year
AT2 = Averaging Time (70 years for carcinogenic effects, 14 years for noncarcinogenic effects)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	NON-CANCER HIF (L/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (L/kg-dy)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals									
Antimony	4.30E-04	8.42E-06	3.62E-09	4.00E-04	9.05E-06	1.68E-06	7.24E-10		
Cadmium	4.00E-04	8.42E-06	3.37E-09	5.00E-04	6.73E-06	1.68E-06	6.73E-10		
Cobalt	2.30E-04	8.42E-06	1.94E-09	6.00E-02	3.23E-08	1.68E-06	3.87E-10		
Nickel	8.60E-03	8.42E-06	7.24E-08	2.00E-02	3.62E-06	1.68E-06	1.45E-08		
Vanadium	7.50E-03	8.42E-06	6.31E-08	7.00E-03	9.02E-06	1.68E-06	1.26E-08		
Volatile Organics									
Acetone	5.10E-03	8.42E-06	4.29E-08	1.00E-01	4.29E-07	1.68E-06	8.58E-09		
Bromomethane	5.60E-03	8.42E-06	4.71E-08	1.40E-03	3.37E-05	1.68E-06	9.43E-09		
Chloromethane	3.60E-03	8.42E-06	3.03E-08			1.68E-06	6.06E-09	1.30E-02	7.88E-11
Iodomethane	1.80E-03	8.42E-06	1.51E-08	NTF		1.68E-06	3.03E-09	NTF	
Methylene chloride	1.40E-03	8.42E-06	1.18E-08	6.00E-02	1.96E-07	1.68E-06	2.36E-09	7.50E-03	1.77E-11
				HAZARD INDEX =	6.27E-05			TOTAL CANCER RISK =	9.64E-11

NTF = No critical toxicity values surrogate toxicity values are not available for these chemicals, therefore, they were not evaluated in the quantitative risk assessment

TABLE A-14

TINKER AFB SITE - OFF-BASE WEST SOLDIER CREEK (AREA 2)
INCIDENTAL INGESTION OF CHEMICALS IN SURFACE WATER DUE TO WADING
OFF-BASE CHILD AND ADULT RESIDENT - RME
(CURRENT AND FUTURE USE SCENARIO)

Equation : HIF = [(IRc x ETc x EFc x EDc) / BWc + (IRa x ETa x EFa x EDa) / BWa] / (AT1 x AT2)
CDI = CW x HIF
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
HIF = Human Intake Factor
CDI = Chronic Daily Intake
CW = Concentration in Surface Water
IRc = Child Ingestion Rate = 0.005 L/hour
ETc = Child Exposure Time = 6 hours/day
EFc = Child Exposure Frequency = 34 days per year
EDc = Child Exposure Duration = 5 years
BWc = Child Body Weight = 15.1 kg
IRa = Adult Ingestion Rate = 0.005 L/hour
ETa = Adult Exposure Time = 2 hour /day
EFa = Adult Exposure Frequency = 4 days per year
EDa = Adult Exposure Duration = 25 years
BW = Adult Body Weight = 57.1 kg
AT1 = Days Per Year = 365 days/year
AT2 = Averaging Time (70 years for carcinogenic effects, 30 years for noncarcinogenic effects)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	NON-CANCER HIF (L/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (L/kg-dy)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals									
Antimony	4.40E-04	3.24E-05	1.43E-08	4.00E-04	3.57E-05	1.39E-05	6.12E-09		
Cadmium	5.20E-04	3.24E-05	1.69E-08	5.00E-04	3.37E-05	1.39E-05	7.23E-09		
Cobalt	3.60E-04	3.24E-05	1.17E-08	6.00E-02	1.95E-07	1.39E-05	5.01E-09		
Nickel	1.60E-02	3.24E-05	5.19E-07	2.00E-02	2.60E-05	1.39E-05	2.22E-07		
Vanadium	1.60E-02	3.24E-05	5.19E-07	7.00E-03	7.42E-05	1.39E-05	2.22E-07		
Volatile Organics									
Acetone	5.40E-03	3.24E-05	1.75E-07	1.00E-01	1.75E-06	1.39E-05	7.51E-08		
Bromomethane	7.20E-03	3.24E-05	2.34E-07	1.40E-03	1.67E-04	1.39E-05	1.00E-07		
Chloromethane	3.60E-03	3.24E-05	1.17E-07			1.39E-05	5.01E-08	1.30E-02	6.51E-10
Iodomethane	1.80E-03	3.24E-05	5.84E-08	NTF		1.39E-05	2.50E-08	NTF	
Methylene chloride	1.40E-03	3.24E-05	4.54E-08	6.00E-02	7.57E-07	1.39E-05	1.95E-08	7.50E-03	1.46E-10
				HAZARD INDEX =	3.39E-04			TOTAL CANCER RISK =	7.97E-10

NTF No critical toxicity values surrogate toxicity values are not available for these chemicals, therefore, they were not evaluated in the quantitative risk assessment

TABLE A-15

TINKER AFB SITE - OFF-BASE WEST SOLDIER CREEK (AREA 2)
DERMAL EXPOSURE TO CHEMICALS IN SURFACE WATER DUE TO WADING
OFF-BASE CHILD AND ADULT RESIDENT - AVERAGE EXPOSURE
(CURRENT AND FUTURE USE SCENARIO)

Equation : HIF ={ [(SAc x ETc x EFc x EDc) / BWc + (SAa x ETa x EFa x EDa) / BWa] / (AT1 x AT2)} x CF
CDI = CW x PC x HIF
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
HIF = Human Intake Factor
CDI = Chronic Daily Intake
CW = Concentration in Surface Water
PC = Chemical-specific Dermal Permeability Constant
SAc = Child Skin Surface Area Available for Contact = 1,800 cm^2
ETc = Child Exposure Time = 3 hours/day
EFc = Child Exposure Frequency = 17 days per year
EDc = Child Exposure Duration = 5 years
BWc = Child Body Weight = 15.1 kg
SAa = Adult Skin Surface Area Available for Contact = 2,800 cm^2
ETa = Adult Exposure Time = 1 hour /day
EFa = Adult Exposure Frequency = 2 days per year
EDa = Adult Exposure Duration = 9 years
BW = Adult Body Weight = 57.1 kg
CF = Conversion Factor (1L/1000cm^2)
AT1 = Days Per Year = 365 days/year
AT2 = Averaging Time (70 years for carcinogenic effects, 14 years for noncarcinogenic effects)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	PC[a] (cm/hr)	NON-CANCER HIF (L/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (L/kg-dy)	CANCER CDI (mg/kg-dy)	SF $(mg/kg-dy)^{-1}$	CANCER RISK (unitless)
Metals										
Antimony	4.30E-04	1.00E-03	6.12E-03	2.63E-09	4.00E-04	6.58E-06	1.22E-03	5.26E-10		
Cadmium	4.00E-04	1.00E-03	6.12E-03	2.45E-09	5.00E-04	4.90E-06	1.22E-03	4.90E-10		
Cobalt	2.30E-04	1.00E-03	6.12E-03	1.41E-09	6.00E-02	2.35E-08	1.22E-03	2.82E-10		
Nickel	8.60E-03	1.00E-03	6.12E-03	5.26E-08	2.00E-02	2.63E-06	1.22E-03	1.05E-08		
Vanadium	7.50E-03	1.00E-03	6.12E-03	4.59E-08	7.00E-03	6.56E-06	1.22E-03	9.18E-09		
Volatile Organics										
Acetone	5.10E-03		6.12E-03				1.22E-03			
Bromomethane	5.60E-03		6.12E-03				1.22E-03			
Chloromethane	3.60E-03		6.12E-03				1.22E-03			
Iodomethane	1.80E-03		6.12E-03				1.22E-03			
Methylene chloride	1.40E-03		6.12E-03				1.22E-03			
					HAZARD INDEX =	2.07E-05			TOTAL CANCER RISK =	0.00E+00

Note
a Due to the volatility, volatile organics are assumed not available for dermal absorption

TABLE A-16

TINKER AFB SITE - OFF-BASE WEST SOLDIER CREEK (AREA 2)
DERMAL EXPOSURE TO CHEMICALS IN SURFACE WATER DUE TO WADING
OFF-BASE CHILD AND ADULT RESIDENT - RME
(CURRENT AND FUTURE USE SCENARIO)

Equation: HIF = { [(SAc x ETc x EFc x EDc) / BWc + (SAa x ETa x EFa x EDa) / BWa] / (AT1 x AT2)} x CF
CDI = CW x PC x HIF
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
HIF = Human Intake Factor
CDI = Chronic Daily Intake
CW = Concentration in Surface Water
PC = Chemical-specific Dermal Permeability Constant
SAc = Child Skin Surface Area Available for Contact = 6,500 cm^2
ETc = Child Exposure Time = 6 hours/day
EFc = Child Exposure Frequency = 34 days per year
EDc = Child Exposure Duration = 5 years
BWc = Child Body Weight = 15.1 kg
SAa = Adult Skin Surface Area Available for Contact = 8,620 cm^2
ETa = Adult Exposure Time = 2 hour /day
EFa = Adult Exposure Frequency = 4 days per year
EDa = Adult Exposure Duration = 25 years
BW = Adult Body Weight = 57.1 kg
CF = Conversion Factor (1L/1000cm^2)
AT1 = Days Per Year = 365 days/year
AT2 = Averaging Time (70 years for carcinogenic effects, 30 years for noncarcinogenic effects)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	PC[a] (cm/hr)	NON-CANCER HIF (L/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (L/kg-dy)	CANCER CDI (mg/kg-dy)	SF $(mg/kg\text{-}dy)^{-1}$	CANCER RISK (unitless)
Metals										
Antimony	4.40E-04	1.00E-03	4.29E-02	1.89E-08	4.00E-04	4.71E-05	1.84E-02	8.08E-09		
Cadmium	5.20E-04	1.00E-03	4.29E-02	2.23E-08	5.00E-04	4.46E-05	1.84E-02	9.55E-09		
Cobalt	3.60E-04	1.00E-03	4.29E-02	1.54E-08	6.00E-02	2.57E-07	1.84E-02	6.61E-09		
Nickel	1.60E-02	1.00E-03	4.29E-02	6.86E-07	2.00E-02	3.43E-05	1.84E-02	2.94E-07		
Vanadium	1.60E-02	1.00E-03	4.29E-02	6.86E-07	7.00E-03	9.80E-05	1.84E-02	2.94E-07		
Volatile Organics										
Acetone	5.40E-03		4.29E-02				1.84E-02			
Bromomethane	7.20E-03		4.29E-02				1.84E-02			
Chloromethane	3.60E-03		4.29E-02				1.84E-02			
Iodomethane	1.80E-03		4.29E-02				1.84E-02			
Methylene chloride	1.40E-03		4.29E-02				1.84E-02			
					HAZARD INDEX =	2.24E-04			TOTAL CANCER RISK =	0.00E+00

Note
a Due to the volatility, volatile organics are assumed not available for dermal absorption.

TABLE A-17

TINKER AFB SITE - OFF-BASE WEST SOLDIER CREEK (AREA 2)
INCIDENTAL INGESTION EXPOSURE TO CHEMICALS IN SEDIMENTS DUE TO WADING
OFF-BASE CHILD AND ADULT RESIDENT - AVERAGE EXPOSURE
(CURRENT AND FUTURE USE SCENARIO)

Equation HIF = {[(IRc x EFc x EDc) / BWc + (IRa x EFa x EDa) / BWa] x CF}/ (AT1x AT2)
CDI = CS x HIF
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
HIF = Human Intake Factor
CDI = Chronic Daily Intake
CS = Concentration in Sediments
IRc = Child Ingestion Rate = 100mg/day
EFc = Child Exposure Frequency = 17 days per year
EDc = Child Exposure Duration = 5 years
BWc = Child Body Weight = 15.1 kg
IRa = Adult Ingestion Rate = 10mg/day
EFa = Adult Exposure Frequency = 2 days per year
EDa = Adult Exposure Duration = 9 years
BW = Adult Body Weight = 57.1 kg
AT1 = Days Per Year = 365 days/year
AT2 = Averaging Time (70 years for carcinogenic effects, 14 years for noncarcinogenic effects)
CF = Conversion Factor = 0.000001 kg/mg
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON CANCER HIF (mg/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (mg/kg-dy)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals									
Antimony	3 90E+00	1 11E-07	4 32E-07	4 00E-04	1 08E-03	2 22E-08	8 64E-08		
Beryllium	2 60E-01	1 11E-07	2 88E-08	5 00E-03	5 76E-06	2 22E-08	5 76E-09	4 30E+00	2 48E-08
Cadmium	7 20E+00	1 11E-07	7 98E-07	1 00E-03	7 98E-04	2 22E-08	1 60E-07		
Chromium (VI)	2 30E+00	1 11E-07	2 55E-07	5 00E-03	5 10E-05	2 22E-08	5 10E-08		
Cobalt	6 80E+00	1 11E-07	7 53E-07	6 00E-02	1 26E-05	2 22E-08	1 51E-07		
Lead	7 50E+01	1 11E-07	8 31E-06	NTF		2 22E-08	1 66E-06	NTF	
Mercury	2 70E-02	1 11E-07	2 99E-09	3 00E-04	9 97E-06	2 22E-08	5 98E-10		
Silver	7 30E+00	1 11E-07	8 09E-07	5 00E-03	1 62E-04	2 22E-08	1 62E-07		
Vanadium	1 50E+01	1 11E-07	1 66E-06	7 00E-03	2 37E-04	2 22E-08	3 32E-07		
Pesticides/PCBs									
Aroclor 1254	2 30E+00	1 11E-07	2 55E-07	2 00E-05	1 27E-02	2 22E-08	5 10E-08	1 00E+00	5 10E-08
Semivolatile Organics									
2-Methylnaphthalene	2 20E-01	1 11E-07	2 44E-08	3 00E-02	8 12E-07	2 22E-08	4 87E-09		
Acenaphthene	6 50E-01	1 11E-07	7 20E-08	6 00E-02	1 20E-06	2 22E-08	1 44E-08		
Anthracene	9 50E-01	1 11E-07	1 05E-07	3 00E-01	3 51E-07	2 22E-08	2 10E-08		
Benzo(a)anthracene	2 60E+00	1 11E-07	2 88E-07			2 22E-08	5 76E-08	7 30E-01	4 21E-08
Benzo(a)pyrene	2 10E+00	1 11E-07	2 33E-07			2 22E-08	4 65E-08	7 30E+00	3 40E-07
Benzo(b)fluoranthene	2 40E+00	1 11E-07	2 66E-07			2 22E-08	5 32E-08	7 30E-01	3 88E-08
Benzo(g,h,i)perylene	1 00E+00	1 11E-07	1 11E-07	3 00E-02	3 69E-06	2 22E-08	2 22E-08		
Benzo(k)fluoranthene	2 20E+00	1 11E-07	2 44E-07			2 22E-08	4 87E-08	7 30E-02	3 56E-09
Butyl benzyl phthalate	2 70E-01	1 11E-07	2 99E-08	2 00E-01	1 50E-07	2 22E-08	5 98E-09		
Chrysene	3 10E+00	1 11E-07	3 43E-07			2 22E-08	6 87E-08	7 30E-03	5 01E-10
Di-n-octyl phthalate	3 10E-01	1 11E-07	3 43E-08	2 00E-02	1 72E-06	2 22E-08	6 87E-09		
Dibenz(a,h)anthracene	2 40E-01	1 11E-07	2 66E-08			2 22E-08	5 32E-09	7 30E+00	3 88E-08
Dibenzofuran	4 50E-01	1 11E-07	4 98E-08	4 00E-03	1 25E-05	2 22E-08	9 97E-09		
Fluoranthene	6 90E+00	1 11E-07	7 64E-07	4 00E-02	1 91E-05	2 22E-08	1 53E-07		
Fluorene	7 00E-01	1 11E-07	7 75E-08	4 00E-02	1 94E-06	2 22E-08	1 55E-08		
Indeno(1,2,3-cd)pyrene	1 10E+00	1 11E-07	1 22E-07			2 22E-08	2 44E-08	7 30E-01	1 78E-08
Naphthalene	3 20E-01	1 11E-07	3 54E-08	3 00E-02	1 18E-06	2 22E-08	7 09E-09		
Phenanthrene	5 40E+00	1 11E-07	5 98E-07	3 00E-02	1 99E-05	2 22E-08	1 20E-07		
Pyrene	6 40E+00	1 11E-07	7 09E-07	3 00E-02	2 36E-05	2 22E-08	1 42E-07		
bis(2-Ethylhexyl)phthalate	1 30E-01	1 11E-07	1 44E-08	2 00E-02	7 20E-07	2 22E-08	2 88E-09	1 40E-02	4 03E-11
Volatile Organics									
Acetone	5 60E-03	1 11E-07	6 20E-10	1 00E-01	6 20E-09	2 22E-08	1 24E-10		
Methylene chloride	1 80E-03	1 11E-07	1 99E-10	6 00E-02	3 32E-09	2 22E-08	3 99E-11	7 50E-03	2 99E-13
					HAZARD INDEX =	1 52E-02		TOTAL CANCER RISK =	5 57E-07

NTF = No critical toxicity values - surrogate toxicity values are not available for these chemicals, therefore, they were not evaluated in the quantitative risk assessment

TABLE A-18

TINKER AFB SITE - OFF-BASE WEST SOLDIER CREEK (AREA 2)
INCIDENTAL INGESTION EXPOSURE TO CHEMICALS IN SEDIMENTS DUE TO WADING
OFF-BASE CHILD AND ADULT RESIDENT - RME
(CURRENT AND FUTURE USE SCENARIO)

Equation HIF = {[(IRc x EFc x EDc) / BWc + (IRa x EFa x EDa) / BWa] x CF}/ (AT1x AT2)
CDI = CS x HIF
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
HIF = Human Intake Factor
CDI = Chronic Daily Intake
CS = Concentration in Sediments
IRc = Child Ingestion Rate = 100mg/day
EFc = Child Exposure Frequency = 17 days per year
EDc = Child Exposure Duration = 5 years
BWc = Child Body Weight = 15.1 kg
IRa = Adult Ingestion Rate = 10mg/day
EFa = Adult Exposure Frequency = 2 days per year
EDa = Adult Exposure Duration = 25 years
BW = Adult Body Weight = 57.1 kg
AT1 = Days Per Year = 365 days/year
AT2 = Averaging Time (70 years for carcinogenic effects, 30 years for noncarcinogenic effects)
CF = Conversion Factor = 0.000001 kg/mg
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER HIF (mg/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (mg/kg-dy)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals									
Antimony	4 40E+00	2 22E-07	9 75E-07	4 00E-04	2 44E-03	9 50E-08	4 18E-07		
Beryllium	5 10E-01	2 22E-07	1 13E-07	5 00E-03	2.26E-05	9 50E-08	4 84E-08	4 30E+00	2 08E-07
Cadmium	1 70E+01	2 22E-07	3 77E-06	1 00E-03	3 77E-03	9 50E-08	1 61E-06		
Chromium (VI)	8 40E+00	2 22E-07	1 86E-06	5 00E-03	3 72E-04	9 50E-08	7 98E-07		
Cobalt	7 30E+00	2 22E-07	1 62E-06	6 00E-02	2 70E-05	9 50E-08	6 93E-07		
Lead	2 50E+02	2 22E-07	5 54E-05	NTF		9 50E-08	2 37E-05	NTF	
Mercury	5 50E-02	2 22E-07	1 22E-08	3 00E-04	4 06E-05	9 50E-08	5 22E-09		
Silver	1 60E+01	2 22E-07	3 55E-06	5 00E-03	7 09E-04	9 50E-08	1 52E-06		
Vanadium	2 30E+01	2 22E-07	5 10E-06	7 00E-03	7 28E-04	9 50E-08	2 18E-06		
Pesticides/PCBs									
Aroclor 1254	6 00E+00	2 22E-07	1 33E-06	2 00E-05	6 65E-02	9 50E-08	5 70E-07	2 00E+00	1 14E-06
Semivolatile Organics									
2-Methylnaphthalene	2 80E-01	2 22E-07	6 21E-08	3 00E-02	2 07E-06	9 50E-08	2 66E-08		
Acenaphthene	2 00E+00	2 22E-07	4 43E-07	6 00E-02	7 39E-06	9 50E-08	1 90E-07		
Anthracene	3 20E+00	2 22E-07	7 09E-07	3 00E-01	2 36E-06	9 50E-08	3 04E-07		
Benzo(a)anthracene	9 90E+00	2 22E-07	2 19E-06			9 50E-08	9 40E-07	7 30E-01	6 86E-07
Benzo(a)pyrene	7 90E+00	2 22E-07	1 75E-06			9 50E-08	7 50E-07	7 30E+00	5 48E-06
Benzo(b)fluoranthene	9 40E+00	2 22E-07	2 08E-06			9 50E-08	8 93E-07	7 30E-01	6 52E-07
Benzo(g,h,i)perylene	3 90E+00	2 22E-07	8 64E-07	3 00E-02	2 88E-05	9 50E-08	3 70E-07		
Benzo(k)fluoranthene	8 30E+00	2 22E-07	1 84E-06			9 50E-08	7 88E-07	7 30E-02	5 75E-08
Butyl benzyl phthalate	4 70E-01	2 22E-07	1 04E-07	2 00E-01	5 21E-07	9 50E-08	4 46E-08		
Chrysene	1 20E+01	2 22E-07	2 66E-06			9 50E-08	1 14E-06	7 30E-03	8 32E-09
Di-n-octyl phthalate	6 60E-01	2 22E-07	1 46E-07	2 00E-02	7 31E-06	9 50E-08	6 27E-08		
Dibenz(a,h)anthracene	3 60E-01	2 22E-07	7 98E-08			9 50E-08	3 42E-08	7 30E+00	2 50E-07
Dibenzofuran	1 20E+00	2 22E-07	2 66E-07	4 00E-03	6 65E-05	9 50E-08	1 14E-07		
Fluoranthene	2 70E+01	2 22E-07	5 98E-06	4 00E-02	1 50E-04	9 50E-08	2 56E-06		
Fluorene	2 20E+00	2 22E-07	4 88E-07	4 00E-02	1 22E-05	9 50E-08	2 09E-07		
Indeno(1,2,3-cd)pyrene	4 30E+00	2 22E-07	9 53E-07			9 50E-08	4 08E-07	7 30E-01	2 98E-07
Naphthalene	6 90E-01	2 22E-07	1 53E-07	3 00E-02	5 10E-06	9 50E-08	6 55E-08		
Phenanthrene	2 10E+01	2 22E-07	4 65E-06	3 00E-02	1 55E-04	9 50E-08	1 99E-06		
Pyrene	2 50E+01	2 22E-07	5 54E-06	3 00E-02	1 85E-04	9 50E-08	2 37E-06		
bis(2-Ethylhexyl)phthalate	1 30E-01	2 22E-07	2 88E-08	2 00E-02	1 44E-06	9 50E-08	1 23E-08	1 40E-02	1 73E-10
Volatile Organics									
Acetone	5 60E-03	2 22E-07	1 24E-09	1 00E-01	1 24E-08	9 50E-08	5 32E-10		
Methylene chloride	1 80E-03	2 22E-07	3 99E-10	6 00E-02	6 65E-09	9 50E-08	1 71E-10	7 50E-03	1 28E-12
				HAZARD INDEX =	7 52E-02			TOTAL CANCER RISK =	8 78E-06

NTF No critical toxicity values surrogate toxicity values are not available for these chemicals, therefore, they were not evaluated in the quantitative risk assessment

TABLE A-19

TINKER AFB SITE - OFF-BASE WEST SOLDIER CREEK (AREA 2)
DERMAL EXPOSURE TO CHEMICALS IN SEDIMENTS DUE TO WADING
OFF-BASE CHILD AND ADULT RESIDENT - AVERAGE EXPOSURE
(CURRENT AND FUTURE USE SCENARIO)

Equation HIF = {[(SAc x EFc x EDc x ABS) / BWc + (SAa x EFa x EDa x ABS) / BWa] x CF} / (AT1 x AT2)
CDI = CS x AF x HIF
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
HIF = Human Intake Factor
CDI = Chronic Daily Intake
CS = Concentration in Sediments
SAc = Child Skin Surface Area Available for Contact = 6,500 cm^2
EFc = Child Exposure Frequency = 17 days per year
EDc = Child Exposure Duration = 5 years
BWc = Child Body Weight = 15.1 kg
SAa = Adult Skin Surface Area Available for Contact = 2,800 cm^2
EFa = Adult Exposure Frequency = 2 days per year
EDa = Adult Exposure Duration = 9 years
BW = AdultBody Weight = 57.1 kg
AF = Adherence Factor = 1.0% for organics and 0.1% for inorganics
ABS = Absorption Factor = 0.2
AT1 = Days Per Year = 365 days/year
AT2 = Averaging Time (70 years for carcinogenic effects, 14 years for noncarcinogenic effects)
CF = Conversion Factor = 0.000001 kg/mg
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER HIF (mg/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (mg/kg-dy)	CANCER CDI (mg/kg-dy)	SF $(mg/kg\text{-}dy)^{-1}$	CANCER RISK (unitless)
Metals									
Antimony	3.90E+00	2.16E-09	1.68E-09	4.00E-04	4.20E-06	4.31E-10	3.36E-10		
Beryllium	2.60E-01	2.16E-09	1.12E-10	5.00E-03	2.24E-08	4.31E-10	2.24E-11	4.30E+00	9.64E-11
Cadmium	7.20E+00	2.16E-09	3.10E-09	1.00E-03	3.10E-06	4.31E-10	6.21E-10		
Chromium (VI)	2.30E+00	2.16E-09	9.92E-10	5.00E-03	1.98E-07	4.31E-10	1.98E-10		
Cobalt	6.80E+00	2.16E-09	2.93E-09	6.00E-02	4.89E-08	4.31E-10	5.86E-10		
Lead	7.50E+01	2.16E-09	3.23E-08	NTF		4.31E-10	6.47E-09	NTF	
Mercury	2.70E-02	2.16E-09	1.16E-11	3.00E-04	3.88E-08	4.31E-10	2.33E-12		
Silver	7.30E+00	2.16E-09	3.15E-09	5.00E-03	6.29E-07	4.31E-10	6.29E-10		
Vanadium	1.50E+01	2.16E-09	6.47E-09	7.00E-03	9.24E-07	4.31E-10	1.29E-09		
Pesticides/PCBs									
Aroclor 1254	2.30E+00	2.16E-08	9.92E-09	2.00E-05	4.96E-04	4.31E-09	1.98E-09	1.00E+00	1.98E-09
Semivolatile Organics									
2-Methylnaphthalene	2.20E-01	2.16E-08	9.48E-10	3.00E-02	3.16E-08	4.31E-09	1.90E-10		
Acenaphthene	6.50E-01	2.16E-08	2.80E-09	6.00E-02	4.67E-08	4.31E-09	5.60E-10		
Anthracene	9.50E-01	2.16E-08	4.10E-09	3.00E-01	1.37E-08	4.31E-09	8.19E-10		
Benzo(a)anthracene	2.60E+00	2.16E-08	1.12E-08			4.31E-09	2.24E-09	7.30E-01	1.64E-09
Benzo(a)pyrene	2.10E+00	2.16E-08	9.05E-09			4.31E-09	1.81E-09	7.30E+00	1.32E-08
Benzo(b)fluoranthene	2.40E+00	2.16E-08	1.03E-08			4.31E-09	2.07E-09	7.30E-01	1.51E-09
Benzo(g,h,i)perylene	1.00E+00	2.16E-08	4.31E-09	3.00E-02	1.44E-07	4.31E-09	8.62E-10		
Benzo(k)fluoranthene	2.20E+00	2.16E-08	9.48E-09			4.31E-09	1.90E-09	7.30E-02	1.38E-10
Butyl benzyl phthalate	2.70E-01	2.16E-08	1.16E-09	2.00E-01	5.82E-09	4.31E-09	2.33E-10		
Chrysene	3.10E+00	2.16E-08	1.34E-08			4.31E-09	2.67E-09	7.30E-03	1.95E-11
Di-n-octyl phthalate	3.10E-01	2.16E-08	1.34E-09	2.00E-02	6.68E-08	4.31E-09	2.67E-10		
Dibenz(a,h)anthracene	2.40E-01	2.16E-08	1.03E-09			4.31E-09	2.07E-10	7.30E+00	1.51E-09
Dibenzofuran	4.50E-01	2.16E-08	1.94E-09	4.00E-03	4.85E-07	4.31E-09	3.88E-10		
Fluoranthene	6.90E+00	2.16E-08	2.97E-08	4.00E-02	7.44E-07	4.31E-09	5.95E-09		
Fluorene	7.00E-01	2.16E-08	3.02E-09	4.00E-02	7.54E-08	4.31E-09	6.04E-10		
Indeno(1,2,3-cd)pyrene	1.10E+00	2.16E-08	4.74E-09			4.31E-09	9.48E-10	7.30E-01	6.92E-10
Naphthalene	3.20E-01	2.16E-08	1.38E-09	3.00E-02	4.60E-08	4.31E-09	2.76E-10		
Phenanthrene	5.40E+00	2.16E-08	2.33E-08	3.00E-02	7.76E-07	4.31E-09	4.66E-09		
Pyrene	6.40E+00	2.16E-08	2.76E-08	3.00E-02	9.20E-07	4.31E-09	5.52E-09		
bis(2-Ethylhexyl)phthalate	1.30E-01	2.16E-08	5.60E-10	2.00E-02	2.80E-08	4.31E-09	1.12E-10	1.40E-02	1.57E-12
Volatile Organics									
Acetone	5.60E-03	2.16E-08	2.41E-11	1.00E-01	2.41E-10	4.31E-09	4.83E-12		
Methylene chloride	1.80E-03	2.16E-08	7.76E-12	6.00E-02	1.29E-10	4.31E-09	1.55E-12	7.50E-03	1.16E-14
				HAZARD INDEX =	5.08E-04			TOTAL CANCER RISK =	2.08E-08

NTF = No critical toxicity values - surrogate toxicity values are not available for these chemicals, therefore, they were not evaluated in the quantitative risk assessment

TABLE A-20

TINKER AFB SITE - OFF-BASE WEST SOLDIER CREEK (AREA 2)
DERMAL EXPOSURE TO CHEMICALS IN SEDIMENTS DUE TO WADING
OFF-BASE CHILD AND ADULT RESIDENT - RME
(CURRENT AND FUTURE USE SCENARIO)

Equation HIF = {[(SAc x EFc x EDc x ABS) / BWc + (SAa x EFa x EDa x ABS) / BWa] x CF} / (AT1 x AT2)
CDI = CS x AF x HIF
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
HIF = Human Intake Factor
CDI = Chronic Daily Intake
CS = Concentration in Sediments
SAc = Child Skin Surface Area Available for Contact = 6,500 cm^2
EFc = Child Exposure Frequency = 34 days per year
EDc = Child Exposure Duration = 5 years
BWc = Child Body Weight = 15.1 kg
SAa = Adult Skin Surface Area Available for Contact = 8,600 cm^2
EFa = Adult Exposure Frequency = 4 days per year
EDa = Adult Exposure Duration = 25 years
BW = AdultBody Weight = 57.1 kg
AF = Adherence Factor = 1.0% for organics and 0.1% for inorganics
ABS = Absorption Factor = 1.0
AT1 = Days Per Year = 365 days/year
AT2 = Averaging Time (70 years for carcinogenic effects, 30 years for noncarcinogenic effects)
CF = Conversion Factor = 0.000001 kg/mg
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER HIF (mg/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (mg/kg-dy)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)$^{-1}$	CANCER RISK (unitless)
Metals									
Antimony	4 40E+00	8 06E-09	3 55E-08	4 00E-04	8 87E-05	3 45E-09	1 52E-08		
Beryllium	5 10E-01	8 06E-09	4 11E-09	5 00E-03	8 22E-07	3 45E-09	1 76E-09	4 30E+00	7 58E-09
Cadmium	1 70E+01	8 06E-09	1 37E-07	1 00E-03	1 37E-04	3 45E-09	5 87E-08		
Chromium (VI)	8 40E+00	8 06E-09	6 77E-08	5 00E-03	1 35E-05	3 45E-09	2 90E-08		
Cobalt	7 30E+00	8 06E-09	5 89E-08	6 00E-02	9 81E-07	3 45E-09	2 52E-08		
Lead	2 50E+02	8 06E-09	2 02E-06	NTF		3 45E-09	8 64E-07	NTF	
Mercury	5 50E-02	8 06E-09	4 43E-10	3 00E-04	1 48E-06	3 45E-09	1 90E-10		
Silver	1 60E+01	8 06E-09	1 29E-07	5 00E-03	2 58E-05	3 45E-09	5 53E-08		
Vanadium	2 30E+01	8 06E-09	1 85E-07	7 00E-03	2 65E-05	3 45E-09	7 95E-08		
Pesticides/PCBs									
Aroclor 1254	6 00E+00	8 06E-08	4 84E-07	2 00E-05	2 42E-02	3 45E-08	2 07E-07	2 00E+00	4 15E-07
Semivolatile Organics									
2-Methylnaphthalene	2 80E-01	8 06E-08	2 26E-08	3 00E-02	7 52E-07	3 45E-08	9 67E-09		
Acenaphthene	2 00E+00	8 06E-08	1 61E-07	6 00E-02	2 69E-06	3 45E-08	6 91E-08		
Anthracene	3 20E+00	8 06E-08	2 58E-07	3 00E-01	8 60E-07	3 45E-08	1 11E-07		
Benzo(a)anthracene	9 90E+00	8 06E-08	7 98E-07			3 45E-08	3 42E-07	7 30E-01	2 50E-07
Benzo(a)pyrene	7 90E+00	8 06E-08	6 37E-07			3 45E-08	2 73E-07	7 30E+00	1 99E-06
Benzo(b)fluoranthene	9 40E+00	8 06E-08	7 58E-07			3 45E-08	3 25E-07	7 30E-01	2 37E-07
Benzo(g,h,i)perylene	3 90E+00	8 06E-08	3 14E-07	3 00E-02	1 05E-05	3 45E-08	1 35E-07		
Benzo(k)fluoranthene	8 30E+00	8 06E-08	6 69E-07			3 45E-08	2 87E-07	7 30E-02	2 09E-08
Butyl benzyl phthalate	4 70E-01	8 06E-08	3 79E-08	2 00E-01	1 89E-07	3 45E-08	1 62E-08		
Chrysene	1 20E+01	8 06E-08	9 67E-07			3 45E-08	4 15E-07	7 30E-03	3 03E-09
Di-n-octyl phthalate	6 60E-01	8 06E-08	5 32E-08	2 00E-02	2 66E-06	3 45E-08	2 28E-08		
Dibenz(a,h)anthracene	3 60E-01	8 06E-08	2 90E-08			3 45E-08	1 24E-08	7 30E+00	9 08E-08
Dibenzofuran	1 20E+00	8 06E-08	9 67E-08	4 00E-03	2 42E-05	3 45E-08	4 15E-08		
Fluoranthene	2 70E+01	8 06E-08	2 18E-06	4 00E-02	5 44E-05	3 45E-08	9 33E-07		
Fluorene	2 20E+00	8 06E-08	1 77E-07	4 00E-02	4 43E-06	3 45E-08	7 60E-08		
Indeno(1,2,3-cd)pyrene	4 30E+00	8 06E-08	3 47E-07			3 45E-08	1 49E-07	7 30E-01	1 08E-07
Naphthalene	6 90E-01	8 06E-08	5 56E-08	3 00E-02	1 85E-06	3 45E-08	2 38E-08		
Phenanthrene	2 10E+01	8 06E-08	1 69E-06	3 00E-02	5 64E-05	3 45E-08	7 26E-07		
Pyrene	2 50E+01	8 06E-08	2 02E-06	3 00E-02	6 72E-05	3 45E-08	8 64E-07		
bis(2-Ethylhexyl)phthalate	1 30E-01	8 06E-08	1 05E-08	2 00E-02	5 24E-07	3 45E-08	4 49E-09	1 40E-02	6 29E-11
Volatile Organics									
Acetone	5 60E-03	8 06E-08	4 51E-10	1 00E-01	4 51E-09	3 45E-08	1 93E-10		
Methylene chloride	1 80E-03	8 06E-08	1 45E-10	6 00E-02	2 42E-09	3 45E-08	6 22E-11	7 50E-03	4 66E-13
				HAZARD INDEX =	2 47E-02			TOTAL CANCER RISK =	3 12E-06

NTF - No critical toxicity values. Surrogate toxicity values are not available for these chemicals, therefore, they were not evaluated in the quantitative risk assessment

AREA 3
ON-BASE EAST SOLDIER CREEK

TABLE A-21

TINKER AFB SITE - ON-BASE EAST SOLDIER CREEK (AREA 3)
INGESTION EXPOSURE TO CHEMICALS IN SURFACE WATER
ON-BASE CONSTRUCTION WORKER - AVERAGE EXPOSURE
(CURRENT AND FUTURE USE SCENARIO)

Equation : CDI = (CW X IR X ET X EF X ED)/ (BW X AT1 X AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CW = Concentration in Surface Water
IR = Ingestion Rate = 0.0025 L/hour
ET = Exposure Time = 4 hours per day
EF = Exposure Frequency = 1 day per year
ED = Exposure Duration = 5 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Averaging Time (70 years for cancer causing effects, 5 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Antimony	2.50E-04	9.78E-11	4.00E-04	2.45E-07	6.99E-12		
Arsenic	2.50E-03	9.78E-10	3.00E-04	3.26E-06	6.99E-11	1.50E+00	1.05E-10
Cadmium	1.40E-03	5.48E-10	5.00E-04	1.10E-06	3.91E-11		
Cobalt	3.40E-04	1.33E-10	6.00E-02	2.22E-09	9.51E-12		
Nickel	8.50E-03	3.33E-09	2.00E-02	1.66E-07	2.38E-10		
Silver	3.80E-04	1.49E-10	5.00E-03	2.97E-08	1.06E-11		
Vanadium	1.30E-02	5.09E-09	7.00E-03	7.27E-07	3.63E-10		
Pesticides/PCBs							
Aroclor 1254	4.90E-04	1.92E-10	2.00E-05	9.59E-06	1.37E-11	1.00E+00	1.37E-11
Semivolatile Organics							
bis(2-Ethylhexyl)phthalate	5.10E-03	2.00E-09	2.00E-02	9.98E-08	1.43E-10	1.40E-02	2.00E-12
Volatile Organics							
Acetone	5.30E-03	2.07E-09	1.00E-01	2.07E-08	1.48E-10		
Bromoform	1.60E-03	6.26E-10	2.00E-02	3.13E-08	4.47E-11	7.90E-03	3.53E-13
Dibromochloromethane	1.80E-03	7.05E-10	2.00E-02	3.52E-08	5.03E-11	8.40E-02	4.23E-12
Ethanol	4.10E-02	1.60E-08	NTF		1.15E-09	NTF	
Methylene chloride	1.30E-03	5.09E-10	6.00E-02	8.48E-09	3.63E-11	7.50E-03	2.73E-13
				HAZARD INDEX=	1.53E-05	TOTAL CANCER RISK=	1.25E-10

NTF = No critical toxicity values - surrogate toxicity values are not available for these chemicals, therefore, they were not evaluated in the quantitative risk assessment

TABLE A-22

TINKER AFB SITE - ON-BASE EAST SOLDIER CREEK (AREA 3)
INGESTION EXPOSURE TO CHEMICALS IN SURFACE WATER
ON-BASE CONSTRUCTION WORKER - RME
(CURRENT AND FUTURE USE SCENARIO)

Equation : CDI = (CW X IR X ET X EF X ED)/ (BW X AT1 X AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CW = Concentration in Surface Water
IR = Ingestion Rate = 0.005 L/hour
ET = Exposure Time = 8 hours/day
EF = Exposure Frequency = 5 days per year
ED = Exposure Duration = 25 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Averaging Time (70 years for cancer causing effects, 25 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Antimony	2.50E-04	1.96E-09	4.00E-04	4.89E-06	6.99E-10		
Arsenic	2.50E-03	1.96E-08	3.00E-04	6.52E-05	6.99E-09	1.50E+00	1.05E-08
Cadmium	3.30E-03	2.58E-08	5.00E-04	5.17E-05	9.23E-09		
Cobalt	4.80E-04	3.76E-09	6.00E-02	6.26E-08	1.34E-09		
Nickel	1.30E-02	1.02E-07	2.00E-02	5.09E-06	3.63E-08		
Silver	4.70E-04	3.68E-09	5.00E-03	7.36E-07	1.31E-09		
Vanadium	1.40E-02	1.10E-07	7.00E-03	1.57E-05	3.91E-08		
Pesticides/PCBs							
Aroclor 1254	5.00E-04	3.91E-09	2.00E-05	1.96E-04	1.40E-09	2.00E+00	2.80E-09
Semivolatile Organics							
bis(2-Ethylhexyl)phthalate	5.70E-03	4.46E-08	2.00E-02	2.23E-06	1.59E-08	1.40E-02	2.23E-10
Volatile Organics							
Acetone	6.10E-03	4.77E-08	1.00E-01	4.77E-07	1.71E-08		
Bromoform	1.60E-03	1.25E-08	2.00E-02	6.26E-07	4.47E-09	7.90E-03	3.53E-11
Dibromochloromethane	1.80E-03	1.41E-08	2.00E-02	7.05E-07	5.03E-09	8.40E-02	4.23E-10
Ethanol	4.10E-02	3.21E-07	NTF		1.15E-07	NTF	
Methylene chloride	1.30E-03	1.02E-08	6.00E-02	1.70E-07	3.63E-09	7.50E-03	2.73E-11
				HAZARD INDEX=	3.43E-04	TOTAL CANCER RISK=	1.40E-08

NTF = No critical toxicity values - surrogate toxicity values are not available for these chemicals; therefore, they were not evaluated in the quantitative risk assessment

TABLE A-23

TINKER AFB SITE - ON-BASE EAST SOLDIER CREEK (AREA 3)
DERMAL EXPOSURE TO CHEMICALS IN SURFACE WATER
ON-BASE CONSTRUCTION WORKER - AVERAGE EXPOSURE
(CURRENT AND FUTURE USE SCENARIOS)

Equation : CDI = (CW x SA x PC x ET x EF x ED x CF)/(BW x AT1 x AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CW = Concentration in Surface Water
SA = Skin Surface Area Available for Contact = 2,000 cm^2
PC = Chemical-specific Dermal Permeability Constant
ET = Exposure Time = 4 hours per day
EF = Exposure Frequency = 1 day per year
ED = Exposure Duration = 5 years
CF = Volumetric Conversion Factor for Water = 0.001 L/cm^3
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Averaging Time (70 years for cancer causing effects, 5 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	PC[a] (cm/hr)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals								
Antimony	2.50E-04	0.001	7.83E-11	4.00E-04	1.96E-07	5.59E-12		
Arsenic	2.50E-03	0.001	7.83E-10	3.00E-04	2.61E-06	5.59E-11	1.50E+00	8.39E-11
Cadmium	1.40E-03	0.001	4.38E-10	5.00E-04	8.77E-07	3.13E-11		
Cobalt	3.40E-04	0.001	1.06E-10	6.00E-02	1.77E-09	7.60E-12		
Nickel	8.50E-03	0.001	2.66E-09	2.00E-02	1.33E-07	1.90E-10		
Silver	3.80E-04	0.001	1.19E-10	5.00E-03	2.38E-08	8.50E-12		
Vanadium	1.30E-02	0.001	4.07E-09	7.00E-03	5.81E-07	2.91E-10		
Pesticides/PCBs								
Aroclor 1254	4.90E-04	0.032	4.91E-09	2.00E-05	2.45E-04	3.51E-10	1.00E+00	3.51E-10
Semivolatile Organics								
bis(2-Ethylhexyl)phthalate	5.10E-03	0.032	5.11E-08	2.00E-02	2.55E-06	3.65E-09	1.40E-02	5.11E-11
Volatile Organics								
Acetone	5.30E-03							
Bromoform	1.60E-03							
Dibromochloromethane	1.80E-03							
Ethanol	4.10E-02							
Methylene chloride	1.30E-03							
				HAZARD INDEX=	2.52E-04	TOTAL CANCER RISK=		4.86E-10

Note
a Due to the volatility, volatile organics are assumed not available for dermal absorption

TABLE A-24

TINKER AFB SITE - ON-BASE EAST SOLDIER CREEK (AREA 3)
DERMAL EXPOSURE TO CHEMICALS IN SURFACE WATER
ON-BASE CONSTRUCTION WORKER - RME
(CURRENT AND FUTURE USE SCENARIOS)

Equation : CDI = (CW x SA x PC x ET x EF x ED x CF)/(BW x AT1 x AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CW = Concentration in Surface Water
SA = Skin Surface Area Available for Contact =9,800 cm^2
PC = Chemical-specific Dermal Permeability Constant
ET = Exposure Time = 8 hours per day
EF = Exposure Frequency = 5 days per year
ED = Exposure Duration = 25 years
CF = Volumetric Conversion Factor for Water = 0.001 L/cm^3
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Averaging Time (70 years for cancer causing effects, 25 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	PC[a] (cm/hr)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals								
Antimony	2.50E-04	0.001	3.84E-09	4.00E-04	9.59E-06	1.37E-09		
Arsenic	2.50E-03	0.001	3.84E-08	3.00E-04	1.28E-04	1.37E-08	1.50E+00	2.05E-08
Cadmium	3.30E-03	0.001	5.06E-08	5.00E-04	1.01E-04	1.81E-08		
Cobalt	4.80E-04	0.001	7.36E-09	6.00E-02	1.23E-07	2.63E-09		
Nickel	1.30E-02	0.001	1.99E-07	2.00E-02	9.97E-06	7.12E-08		
Silver	4.70E-04	0.001	7.21E-09	5.00E-03	1.44E-06	2.58E-09		
Vanadium	1.40E-02	0.001	2.15E-07	7.00E-03	3.07E-05	7.67E-08		
Pesticides/PCBs								
Aroclor 1254	5.00E-04	0.032	2.45E-07	2.00E-05	1.23E-02	8.77E-08	2.00E+00	1.75E-07
Semivolatile Organics								
bis(2-Ethylhexyl)phthalate	5.70E-03	0.032	2.80E-06	2.00E-02	1.40E-04	9.99E-07	1.40E-02	1.40E-08
Volatile Organics								
Acetone	6.10E-03							
Bromoform	1.60E-03							
Dibromochloromethane	1.80E-03							
Ethanol	4.10E-02							
Methylene chloride	1.30E-03							
				HAZARD INDEX =	1.27E-02	TOTAL CANCER RISK =		2.10E-07

Note:
a Due to the volatility, volatile organics are assumed not available for dermal absorption.

TABLE A-25

TINKER AFB SITE - ON-BASE EAST SOLDIER CREEK (AREA 3)
DERMAL EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER - AVERAGE EXPOSURE
(CURRENT USE SCENARIO)

Equation CDI = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT1 x AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CS = Concentration in Sediments
CF = Conversion Factor (10^{-6} kg/mg)
SA = Skin Surface Area Available for Contact = 2,000 cm^2
AF = Dermal Soil Adherence Factor = 0.2 mg/cm^2
ABS = Absorption Factor = 1.0% for organics and 0.1% for inorganics
EF = Exposure Frequency = 1 day per year
ED = Exposure Duration = 5 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Averaging Time (70 years for cancer causing effects, 5 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Antimony	4.90E+00	7.67E-11	4.00E-04	1.92E-07	5.48E-12		
Beryllium	4.90E-01	7.67E-12	5.00E-03	1.53E-09	5.48E-13	4.30E+00	2.36E-12
Cadmium	6.20E+01	9.71E-10	1.00E-03	9.71E-07	6.93E-11		
Chromium	4.90E+02	7.67E-09	5.00E-03	1.53E-06	5.48E-10		
Cobalt	1.50E+01	2.35E-10	6.00E-02	3.91E-09	1.68E-11		
Lead	1.70E+02	2.66E-09	NTF		1.90E-10	NTF	
Mercury	1.10E+00	1.72E-11	3.00E-04	5.74E-08	1.23E-12		
Silver	4.70E+00	7.36E-11	5.00E-03	1.47E-08	5.26E-12		
Thallium	7.30E+01	1.14E-09	8.00E-05	1.43E-05	8.16E-11		
Vanadium	2.90E+01	4.54E-10	7.00E-03	6.49E-08	3.24E-11		
PCBs/Pesticides							
4,4'-DDD	4.20E-02	6.58E-12			4.70E-13	2.40E-01	1.13E-13
Aldrin	3.50E-02	5.48E-12	3.00E-05	1.83E-07	3.91E-13	1.70E+01	6.65E-12
Aroclor 1254	1.50E+00	2.35E-10	2.00E-05	1.17E-05	1.68E-11	1.00E+00	1.68E-11
Aroclor 1260	6.30E-01	9.86E-11			7.05E-12	1.00E+00	7.05E-12
Endosulfan II	6.50E-02	1.02E-11	6.00E-03	1.70E-09	7.27E-13		
alpha-Chlordane	1.30E-02	2.04E-12	6.00E-05	3.39E-08	1.45E-13	1.30E+00	1.89E-13
gamma-Chlordane	2.30E-02	3.60E-12	6.00E-05	6.00E-08	2.57E-13	1.30E+00	3.34E-13
Semivolatile Organics							
1,2-Dichlorobenzene	2.20E-01	3.44E-11	9.00E-02	3.83E-10	2.46E-12		
1,4-Dichlorobenzene	1.30E-01	2.04E-11			1.45E-12	2.40E-02	3.49E-14
1-Chloronaphthalene	1.60E-01	2.50E-11	3.00E-02	8.35E-10	1.79E-12		
2,4-Dimethylphenol	6.40E-02	1.00E-11	2.00E-02	5.01E-10	7.16E-13		
2-Chloronaphthalene	5.00E-01	7.83E-11	8.00E-02	9.78E-10	5.59E-12		
2-Methylnaphthalene	4.70E-01	7.36E-11	3.00E-02	2.45E-09	5.26E-12		
3-Methylcholanthrene	2.50E-01	3.91E-11	NTF		2.80E-12	NTF	
Acenaphthene	8.10E-01	1.27E-10	6.00E-02	2.11E-09	9.06E-12		
Acetophenone	1.10E-01	1.72E-11	1.00E-01	1.72E-10	1.23E-12		
Anthracene	1.20E+00	1.88E-10	3.00E-01	6.26E-10	1.34E-11		
Benzo(a)anthracene	2.90E+00	4.54E-10			3.24E-11	7.30E-01	2.37E-11
Benzo(a)pyrene	3.20E+00	5.01E-10			3.58E-11	7.30E+00	2.61E-10
Benzo(b)fluoranthene	3.80E+00	5.95E-10			4.25E-11	7.30E-01	3.10E-11
Benzo(g,h,i)perylene	1.60E+00	2.50E-10	3.00E-02	8.35E-09	1.79E-11		
Benzo(k)fluoranthene	3.00E+00	4.70E-10			3.35E-11	7.30E-02	2.45E-12
Benzoic acid	2.80E-01	4.38E-11	4.00E+00	1.10E-11	3.13E-12		
Butyl benzyl phthalate	5.10E-01	7.98E-11	2.00E-01	3.99E-10	5.70E-12		
Chrysene	4.00E+00	6.26E-10			4.47E-11	7.30E-03	3.27E-13
Di-n-butyl phthalate	6.80E-02	1.06E-11	1.00E-01	1.06E-10	7.60E-13		
Dibenz(a,h)anthracene	7.80E-01	1.22E-10			8.72E-12	7.30E+00	6.37E-11
Dibenzofuran	6.70E-01	1.05E-10	4.00E-03	2.62E-08	7.49E-12		
Fluoranthene	9.80E+00	1.53E-09	4.00E-02	3.84E-08	1.10E-10		
Fluorene	7.70E-01	1.21E-10	4.00E-02	3.01E-09	8.61E-12		
Indeno(1,2,3-cd)pyrene	1.70E+00	2.66E-10			1.90E-11	7.30E-01	1.39E-11
Naphthalene	9.40E-01	1.47E-10	3.00E-02	4.91E-09	1.05E-11		
Phenanthrene	5.90E+00	9.24E-10	3.00E-02	3.08E-08	6.60E-11		
Pyrene	6.20E+00	9.71E-10	3.00E-02	3.24E-08	6.93E-11		
bis(2-Ethylhexyl)phthalate	2.80E+00	4.38E-10	2.00E-02	2.19E-08	3.13E-11	1.40E-02	4.38E-13
Volatile Organics							
1,1,2,2-Tetrachloroethane	2.70E-03	4.23E-13			3.02E-14	2.00E-01	6.04E-15
1,1-Dichloroethane	1.60E-03	2.50E-13	1.00E-01	2.50E-12	1.79E-14		
2-Butanone (MEK)	1.40E-02	2.19E-12	6.00E-01	3.65E-12	1.57E-13		
Acetone	5.80E-02	9.08E-12	1.00E-01	9.08E-11	6.49E-13		
Benzene	5.40E-03	8.45E-13			6.04E-14	2.90E-02	1.75E-15
Carbon disulfide	5.80E-03	9.08E-13	1.00E-01	9.08E-12	6.49E-14		
Chlorobenzene	1.30E-01	2.04E-11	2.00E-02	1.02E-09	1.45E-12		
Chloromethane	1.20E-02	1.88E-12			1.34E-13	1.30E-02	1.74E-15
Ethylbenzene	6.10E-03	9.55E-13	1.00E-01	9.55E-12	6.82E-14		
Methylene chloride	5.00E-03	7.83E-13	6.00E-02	1.30E-11	5.59E-14	7.50E-03	4.19E-16
Styrene	8.10E-03	1.27E-12	2.00E-01	6.34E-12	9.06E-14		
Trichloroethene	1.90E-03	2.97E-13	6.00E-03	4.96E-11	2.12E-14	1.10E-02	2.34E-16
			HAZARD INDEX =	2.93E-05	TOTAL CANCER RISK =		4.30E-10

NTF = No critical toxicity values; surrogate toxicity values are not available for these chemicals; therefore, they were not evaluated in the quantitative risk assessment

TABLE A-26

TINKER AFB SITE - ON-BASE EAST SOLDIER CREEK (AREA 3)
DERMAL EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER - RME
(CURRENT USE SCENARIO)

Equation CDI = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT1 x AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
- CDI = Chronic Daily Intake
- CS = Concentration in Sediments
- CF = Conversion Factor (10^{-6} kg/mg)
- SA = Skin Surface Area Available for Contact = 9,800 cm^2
- AF = Dermal Soil Adherence Factor = 1.0 mg/cm^2
- ABS = Absorption Factor = 1.0% for organics and 0.1% for inorganics
- EF = Exposure Frequency = 5 days per year
- ED = Exposure Duration = 25 years
- BW = Body Weight = 70 kg
- AT1 = Days Per Year = 365 days
- AT2 = Averaging Time (70 years for cancer causing effects, 25 years for effects other than carcinogenicity)
- SF = Slope Factor
- RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Antimony	5.60E+00	1.07E-08	4.00E-04	2.68E-05	3.84E-09		
Beryllium	7.40E-01	1.42E-09	5.00E-03	2.84E-07	5.07E-10	4.30E+00	2.18E-09
Cadmium	8.37E+02	1.61E-06	1.00E-03	1.61E-03	5.73E-07		
Chromium	1.80E+03	3.45E-06	5.00E-03	6.90E-04	1.23E-06		
Cobalt	2.20E+01	4.22E-08	6.00E-02	7.03E-07	1.51E-08		
Lead	5.28E+02	1.01E-06	NTF		3.62E-07	NTF	
Mercury	3.50E+00	6.71E-09	3.00E-04	2.24E-05	2.40E-09		
Silver	1.30E+01	2.49E-08	5.00E-03	4.99E-06	8.90E-09		
Thallium	7.30E+01	1.40E-07	8.00E-05	1.75E-03	5.00E-08		
Vanadium	3.70E+01	7.10E-08	7.00E-03	1.01E-05	2.53E-08		
PCBs/Pesticides							
4,4'-DDD	4.20E-02	8.05E-10			2.88E-10	2.40E-01	6.90E-11
Aldrin	9.70E-02	1.86E-09	3.00E-05	6.20E-05	6.64E-10	1.70E+01	1.13E-08
Aroclor 1254	1.00E+01	1.92E-07	2.00E-05	9.59E-03	6.85E-08	2.00E+00	1.37E-07
Aroclor 1260	6.80E-01	1.30E-08			4.66E-09	2.00E+00	9.32E-09
Endosulfan II	9.30E-02	1.78E-09	6.00E-03	2.97E-07	6.37E-10		
alpha-Chlordane	1.30E-02	2.49E-10	6.00E-05	4.16E-06	8.90E-11	1.30E+00	1.16E-10
gamma-Chlordane	2.30E-02	4.41E-10	6.00E-05	7.35E-06	1.58E-10	1.30E+00	2.05E-10
Semivolatile Organics							
1,2-Dichlorobenzene	2.20E-01	4.22E-09	9.00E-02	4.69E-08	1.51E-09		
1,4-Dichlorobenzene	1.30E-01	2.49E-09			8.90E-10	2.40E-02	2.14E-11
1-Chloronaphthalene	1.60E-01	3.07E-09	3.00E-02	1.02E-07	1.10E-09		
2,4-Dimethylphenol	6.40E-02	1.23E-09	2.00E-02	6.14E-08	4.38E-10		
2-Chloronaphthalene	5.00E-01	9.59E-09	8.00E-02	1.20E-07	3.42E-09		
2-Methylnaphthalene	4.70E-01	9.01E-09	3.00E-02	3.00E-07	3.22E-09		
3-Methylcholanthrene	2.50E-01	4.79E-09	NTF		1.71E-09	NTF	
Acenaphthene	1.80E+00	3.45E-08	6.00E-02	5.75E-07	1.23E-08		
Acetophenone	1.10E-01	2.11E-09	1.00E-01	2.11E-08	7.53E-10		
Anthracene	4.00E+00	7.67E-08	3.00E-01	2.56E-07	2.74E-08		
Benzo(a)anthracene	9.10E+00	1.75E-07			6.23E-08	7.30E-01	4.55E-08
Benzo(a)pyrene	1.10E+01	2.11E-07			7.53E-08	7.30E+00	5.50E-07
Benzo(b)fluoranthene	1.30E+01	2.49E-07			8.90E-08	7.30E-01	6.50E-08
Benzo(g,h,i)perylene	4.50E+00	8.63E-08	3.00E-02	2.88E-06	3.08E-08		
Benzo(k)fluoranthene	1.20E+01	2.30E-07			8.22E-08	7.30E-02	6.00E-09
Benzoic acid	2.80E-01	5.37E-09	4.00E+00	1.34E-09	1.92E-09		
Butyl benzyl phthalate	5.10E-01	9.78E-09	2.00E-01	4.89E-08	3.49E-09		
Chrysene	1.20E+01	2.30E-07			8.22E-08	7.30E-03	6.00E-10
Di-n-butyl phthalate	6.80E-02	1.30E-09	1.00E-01	1.30E-08	4.66E-10		
Dibenz(a,h)anthracene	1.80E+00	3.45E-08			1.23E-08	7.30E+00	9.00E-08
Dibenzofuran	1.50E+00	2.88E-08	4.00E-03	7.19E-06	1.03E-08		
Fluoranthene	3.20E+01	6.14E-07	4.00E-02	1.53E-05	2.19E-07		
Fluorene	1.70E+00	3.26E-08	4.00E-02	8.15E-07	1.16E-08		
Indeno(1,2,3-cd)pyrene	4.60E+00	8.82E-08			3.15E-08	7.30E-01	2.30E-08
Naphthalene	2.10E+00	4.03E-08	3.00E-02	1.34E-06	1.44E-08		
Phenanthrene	1.80E+01	3.45E-07	3.00E-02	1.15E-05	1.23E-07		
Pyrene	1.70E+01	3.26E-07	3.00E-02	1.09E-05	1.16E-07		
bis(2-Ethylhexyl)phthalate	1.30E+01	2.49E-07	2.00E-02	1.25E-05	8.90E-08	1.40E-02	1.25E-09
Volatile Organics							
1,1,2,2-Tetrachloroethane	2.70E-03	5.18E-11			1.85E-11	2.00E-01	3.70E-12
1,1-Dichloroethane	1.60E-03	3.07E-11	1.00E-01	3.07E-10	1.10E-11		
2-Butanone (MEK)	2.30E-02	4.41E-10	6.00E-01	7.35E-10	1.58E-10		
Acetone	1.50E-01	2.88E-09	1.00E-01	2.88E-08	1.03E-09		
Benzene	6.80E-03	1.30E-10			4.66E-11	2.90E-02	1.35E-12
Carbon disulfide	7.90E-03	1.52E-10	1.00E-01	1.52E-09	5.41E-11		
Chlorobenzene	1.90E-01	3.64E-09	2.00E-02	1.82E-07	1.30E-09		
Chloromethane	2.70E-02	5.26E-10			1.16E-10	1.30E-02	1.51E-12
Ethylbenzene	8.10E-03	1.55E-10	1.00E-01	1.55E-09	5.55E-11		
Methylene chloride	6.50E-03	1.25E-10	6.00E-02	2.08E-09	4.45E-11	7.50E-03	3.34E-13
Styrene	1.20E-02	2.30E-10	2.00E-01	1.15E-09	8.22E-11		
Trichloroethene	1.00E-03	1.64E-11	6.00E-03	6.07E-09	1.70E-11	1.10E-02	1.43E-13
			HAZARD INDEX =	1.38E-02		TOTAL CANCER RISK =	9.42E-07

NTF = No critical toxicity values - surrogate toxicity values are not available for these chemicals, therefore, they were not evaluated in the quantitative risk assessment.

TABLE A-27

TINKER AFB SITE - ON-BASE EAST SOLDIER CREEK (AREA 3)
INGESTION EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER - AVERAGE EXPOSURE
(CURRENT USE SCENARIO)

Equation CDI = (CS x CF x IR x EF x ED)/(BW x AT1 x AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CS = Concentration in Sediments
CF = Conversion Factor (10^{-6} kg/mg)
IR = Sediment Ingestion Rate = 10 mg/day
EF = Exposure Frequency = 1 day per year
ED = Exposure Duration = 5 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Average Time (70 years for cancer causing effects, 5 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Antimony	4.90E+00	1.92E-09	4.00E-04	4.79E-06	1.37E-10		
Beryllium	4.90E-01	1.92E-10	5.00E-03	3.84E-08	1.37E-11	4.30E+00	5.89E-11
Cadmium	6.20E+01	2.43E-08	1.00E-03	2.43E-05	1.73E-09		
Chromium	4.90E+02	1.92E-07	5.00E-03	3.84E-05	1.37E-08		
Cobalt	1.50E+01	5.87E-09	6.00E-02	9.78E-08	4.19E-10		
Lead	1.70E+02	6.65E-08	NTF		4.75E-09	NTF	
Mercury	1.10E+00	4.31E-10	3.00E-04	1.44E-06	3.08E-11		
Silver	4.70E+00	1.84E-09	5.00E-03	3.68E-07	1.31E-10		
Thallium	7.30E+01	2.86E-08	8.00E-05	3.57E-04	2.04E-09		
Vanadium	2.90E+01	1.14E-08	7.00E-03	1.62E-06	8.11E-10		
PCBs/Pesticides							
4,4'-DDD	4.20E-02	1.64E-11			1.17E-12	2.40E-01	2.82E-13
Aldrin	3.50E-02	1.37E-11	3.00E-05	4.57E-07	9.78E-13	1.70E+01	1.66E-11
Aroclor 1254	1.50E+00	5.87E-10	2.00E-05	2.94E-05	4.19E-11	1.00E+00	4.19E-11
Aroclor 1260	6.30E-01	2.47E-10			1.76E-11	1.00E+00	1.76E-11
Endosulfan II	6.50E-02	2.54E-11	6.00E-03	4.24E-09	1.82E-12		
alpha-Chlordane	1.30E-02	5.09E-12	6.00E-05	8.48E-08	3.63E-13	1.30E+00	4.72E-13
gamma-Chlordane	2.30E-02	9.00E-12	6.00E-05	1.50E-07	6.43E-13	1.30E+00	8.36E-13
Semivolatile Organics							
1,2-Dichlorobenzene	2.20E-01	8.61E-11	9.00E-02	9.57E-10	6.15E-12		
1,4-Dichlorobenzene	1.30E-01	5.09E-11			3.63E-12	2.40E-02	8.72E-14
1-Chloronaphthalene	1.60E-01	6.26E-11	3.00E-02	2.09E-09	4.47E-12		
2,4-Dimethylphenol	6.40E-02	2.50E-11	2.00E-02	1.25E-09	1.79E-12		
2-Chloronaphthalene	5.00E-01	1.96E-10	8.00E-02	2.45E-09	1.40E-11		
2-Methylnaphthalene	4.70E-01	1.84E-10	3.00E-02	6.13E-09	1.31E-11		
3-Methylcholanthrene	2.50E-01	9.78E-11	NTF		6.99E-12	NTF	
Acenaphthene	8.10E-01	3.17E-10	6.00E-02	5.28E-09	2.26E-11		
Acetophenone	1.10E-01	4.31E-11	1.00E-01	4.31E-10	3.08E-12		
Anthracene	1.20E+00	4.70E-10	3.00E-01	1.57E-09	3.35E-11		
Benzo(a)anthracene	2.90E+00	1.14E-09			8.11E-11	7.30E-01	5.92E-11
Benzo(a)pyrene	3.20E+00	1.25E-09			8.95E-11	7.30E+00	6.53E-10
Benzo(b)fluoranthene	3.80E+00	1.49E-09			1.06E-10	7.30E-01	7.76E-11
Benzo(g,h,i)perylene	1.60E+00	6.26E-10	3.00E-02	2.09E-08	4.47E-11		
Benzo(k)fluoranthene	3.00E+00	1.17E-09			8.39E-11	7.30E-02	6.12E-12
Benzoic acid	2.80E-01	1.10E-10	4.00E+00	2.74E-11	7.83E-12		
Butyl benzyl phthalate	5.10E-01	2.00E-10	2.00E-01	9.98E-10	1.43E-11		
Chrysene	4.00E+00	1.57E-09			1.12E-10	7.30E-03	8.16E-13
Di-n-butyl phthalate	6.80E-02	2.66E-11	1.00E-01	2.66E-10	1.90E-12		
Dibenz(a,h)anthracene	7.80E-01	3.05E-10			2.18E-11	7.30E+00	1.59E-10
Dibenzofuran	6.70E-01	2.62E-10	4.00E-03	6.56E-08	1.87E-11		
Fluoranthene	9.80E+00	3.84E-09	4.00E-02	9.59E-08	2.74E-10		
Fluorene	7.70E-01	3.01E-10	4.00E-02	7.53E-09	2.15E-11		
Indeno(1,2,3-cd)pyrene	1.70E+00	6.65E-10			4.75E-11	7.30E-01	3.47E-11
Naphthalene	9.40E-01	3.68E-10	3.00E-02	1.23E-08	2.63E-11		
Phenanthrene	5.90E+00	2.31E-09	3.00E-02	7.70E-08	1.65E-10		
Pyrene	6.20E+00	2.43E-09	3.00E-02	8.09E-08	1.73E-10		
bis(2-Ethylhexyl)phthalate	2.80E+00	1.10E-09	2.00E-02	5.48E-08	7.83E-11	1.40E-02	1.10E-12
Volatile Organics							
1,1,2,2-Tetrachloroethane	2.70E-03	1.06E-12			7.55E-14	2.00E-01	1.51E-14
1,1-Dichloroethane	1.60E-03	6.26E-13	1.00E-01	6.26E-12	4.47E-14		
2-Butanone (MEK)	1.40E-02	5.48E-12	6.00E-01	9.13E-12	3.91E-13		
Acetone	5.80E-02	2.27E-11	1.00E-01	2.27E-10	1.62E-12		
Benzene	5.40E-03	2.11E-12			1.51E-13	2.90E-02	4.38E-15
Carbon disulfide	5.80E-03	2.27E-12	1.00E-01	2.27E-11	1.62E-13		
Chlorobenzene	1.30E-01	5.09E-11	2.00E-02	2.54E-09	3.63E-12		
Chloromethane	1.20E-02	4.70E-12			3.35E-13	1.30E-02	4.36E-15
Ethylbenzene	6.10E-03	2.39E-12	1.00E-01	2.39E-11	1.71E-13		
Methylene chloride	5.00E-03	1.96E-12	6.00E-02	3.26E-11	1.40E-13	7.50E-03	1.05E-15
Styrene	8.10E-03	3.17E-12	2.00E-01	1.59E-11	2.26E-13		
Trichloroethene	1.90E-03	7.44E-13	6.00E-03	1.24E-10	5.31E-14	1.10E-02	5.84E-16
			HAZARD INDEX =	4.59E-04	TOTAL CANCER RISK =		1.13E-09

NTF = No critical toxicity values - surrogate toxicity values are not available for these chemicals therefore, they were not evaluated in the quantitative risk assessment

TABLE A-28

TINKER AFB SITE - ON-BASE EAST SOLDIER CREEK (AREA 3)
INGESTION EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER - RME
(CURRENT USE SCENARIO)

Equation: CDI = (CS x CF x IR x EF x ED)/(BW x AT1 x AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CS = Concentration in Sediments
CF = Conversion Factor (10^{-6} kg/mg)
IR = Sediment Ingestion Rate = 50 mg/day
EF = Exposure Frequency = 5 days per year
ED = Exposure Duration = 25 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Average Time (70 years for cancer causing effects, 25 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Antimony	5.60E+00	5.48E-08	4.00E-04	1.37E-04	1.96E-08		
Beryllium	7.40E-01	7.24E-09	5.00E-03	1.45E-06	2.59E-09	4.30E+00	1.11E-08
Cadmium	8.37E+02	8.19E-06	1.00E-03	8.19E-03	2.92E-06		
Chromium	1.80E+03	1.76E-05	5.00E-03	3.52E-03	6.29E-06		
Cobalt	2.20E+01	2.15E-07	6.00E-02	3.59E-06	7.69E-08		
Lead	5.28E+02	5.17E-06	NTF		1.85E-06	NTF	
Mercury	3.50E+00	3.42E-08	3.00E-04	1.14E-04	1.22E-08		
Silver	1.30E+01	1.27E-07	5.00E-03	2.54E-05	4.54E-08		
Thallium	7.30E+01	7.14E-07	8.00E-05	8.93E-03	2.55E-07		
Vanadium	3.70E+01	3.62E-07	7.00E-03	5.17E-05	1.29E-07		
PCBs/Pesticides							
4,4'-DDD	4.20E-02	4.11E-10			1.47E-10	2.40E-01	3.52E-11
Aldrin	9.70E-02	9.49E-10	3.00E-05	3.16E-05	3.39E-10	1.70E+01	5.76E-09
Aroclor 1254	1.00E+01	9.78E-08	2.00E-05	4.89E-03	3.49E-08	2.00E+00	6.99E-08
Aroclor 1260	6.80E-01	6.65E-09			2.38E-09	2.00E+00	4.75E-09
Endosulfan II	9.30E-02	9.10E-10	6.00E-03	1.52E-07	3.25E-10		
alpha-Chlordane	1.30E-02	1.27E-10	6.00E-05	2.12E-06	4.54E-11	1.30E+00	5.91E-11
gamma-Chlordane	2.30E-02	2.25E-10	6.00E-05	3.75E-06	8.04E-11	1.30E+00	1.04E-10
Semivolatile Organics							
1,2-Dichlorobenzene	2.20E-01	2.15E-09	9.00E-02	2.39E-08	7.69E-10		
1,4-Dichlorobenzene	1.30E-01	1.27E-09			4.54E-10	2.40E-02	1.09E-11
1-Chloronaphthalene	1.60E-01	1.57E-09	3.00E-02	5.22E-08	5.59E-10		
2,4-Dimethylphenol	6.40E-02	6.26E-10	2.00E-02	3.13E-08	2.24E-10		
2-Chloronaphthalene	5.00E-01	4.89E-09	8.00E-02	6.12E-08	1.75E-09		
2-Methylnaphthalene	4.70E-01	4.60E-09	3.00E-02	1.53E-07	1.64E-09		
3-Methylcholanthrene	2.50E-01	2.45E-09	NTF		8.74E-10	NTF	
Acenaphthene	1.80E+00	1.76E-08	6.00E-02	2.94E-07	6.29E-09		
Acetophenone	1.10E-01	1.08E-09	1.00E-01	1.08E-08	3.84E-10		
Anthracene	4.00E+00	3.91E-08	3.00E-01	1.30E-07	1.40E-08		
Benzo(a)anthracene	9.10E+00	8.90E-08			3.18E-08	7.30E-01	2.32E-08
Benzo(a)pyrene	1.10E+01	1.08E-07			3.84E-08	7.30E+00	2.81E-07
Benzo(b)fluoranthene	1.30E+01	1.27E-07			4.54E-08	7.30E-01	3.32E-08
Benzo(g,h,i)perylene	4.50E+00	4.40E-08	3.00E-02	1.47E-06	1.57E-08		
Benzo(k)fluoranthene	1.20E+01	1.17E-07			4.19E-08	7.30E-02	3.06E-09
Benzoic acid	2.80E-01	2.74E-09	4.00E+00	6.85E-10	9.78E-10		
Butyl benzyl phthalate	5.10E-01	4.99E-09	2.00E-01	2.50E-08	1.78E-09		
Chrysene	1.20E+01	1.17E-07			4.19E-08	7.30E-03	3.06E-10
Di-n-butyl phthalate	6.80E-02	6.65E-10	1.00E-01	6.65E-09	2.38E-10		
Dibenz(a,h)anthracene	1.80E+00	1.76E-08			6.29E-09	7.30E+00	4.59E-08
Dibenzofuran	1.50E+00	1.47E-08	4.00E-03	3.67E-06	5.24E-09		
Fluoranthene	3.20E+01	3.13E-07	4.00E-02	7.83E-06	1.12E-07		
Fluorene	1.70E+00	1.66E-08	4.00E-02	4.16E-07	5.94E-09		
Indeno(1,2,3-cd)pyrene	4.60E+00	4.50E-08			1.61E-08	7.30E-01	1.17E-08
Naphthalene	2.10E+00	2.05E-08	3.00E-02	6.85E-07	7.34E-09		
Phenanthrene	1.80E+01	1.76E-07	3.00E-02	5.87E-06	6.29E-08		
Pyrene	1.70E+01	1.66E-07	3.00E-02	5.54E-06	5.94E-08		
bis(2-Ethylhexyl)phthalate	1.30E+01	1.27E-07	2.00E-02	6.36E-06	4.54E-08	1.40E-02	6.36E-10
Volatile Organics							
1,1,2,2-Tetrachloroethane	2.70E-03	2.64E-11			9.44E-12	2.00E-01	1.89E-12
1,1-Dichloroethane	1.60E-03	1.57E-11	1.00E-01	1.57E-10	5.59E-12		
2-Butanone (MEK)	2.30E-02	2.25E-10	6.00E-01	3.75E-10	8.04E-11		
Acetone	1.50E-01	1.47E-09	1.00E-01	1.47E-08	5.24E-10		
Benzene	6.80E-03	6.65E-11			2.38E-11	2.90E-02	6.89E-13
Carbon disulfide	7.90E-03	7.73E-11	1.00E-01	7.73E-10	2.76E-11		
Chlorobenzene	1.90E-01	1.86E-09	2.00E-02	9.30E-08	6.64E-10		
Chloromethane	1.70E-02	1.66E-10			5.94E-11	1.30E-02	7.72E-13
Ethylbenzene	8.10E-03	7.93E-11	1.00E-01	7.93E-10	2.83E-11		
Methylene chloride	6.50E-03	6.36E-11	6.00E-02	1.06E-09	2.27E-11	7.50E-03	1.70E-13
Styrene	1.20E-02	1.17E-10	2.00E-01	5.87E-10	4.19E-11		
Trichloroethene	1.90E-03	1.86E-11	6.00E-03	3.10E-09	6.64E-12	1.10E-02	7.30E-14
			HAZARD INDEX =	2.59E-02		TOTAL CANCER RISK =	4.90E-07

NTF = No critical toxicity values; surrogate toxicity values are not available for these chemicals; therefore, they were not evaluated in the quantitative risk assessment.

TABLE A-29

TINKER AFB SITE - ON-BASE EAST SOLDIER CREEK (AREA 3)
DERMAL EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER - AVERAGE EXPOSURE
(FUTURE USE SCENARIO)

Equation CDI = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT1 x AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CS = Concentration in Sediments
CF = Conversion Factor (10^{-6} kg/mg)
SA = Skin Surface Area Available for Contact = 2,000 cm^2
AF = Dermal Soil Adherence Factor = 0.2 mg/cm^2
ABS = Absorption Factor = 1.0% for organics and 0.1% for inorganics
EF = Exposure Frequency = 1 day per year
ED = Exposure Duration = 5 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Averaging Time (70 years for cancer causing effects, 5 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Antimony	4.90E+00	7.67E-11	4.00E-04	1.92E-07	5.48E-12		
Beryllium	4.50E-01	7.05E-12	5.00E-03	1.41E-09	5.03E-13	4.30E+00	2.16E-12
Cadmium	5.80E+01	9.08E-10	1.00E-03	9.08E-07	6.49E-11		
Chromium	4.20E+02	6.58E-09	5.00E-03	1.32E-06	4.70E-10		
Cobalt	1.20E+01	1.88E-10	6.00E-02	3.13E-09	1.34E-11		
Lead	1.40E+02	2.19E-09	NTF		1.57E-10	NTF	
Mercury	7.00E-01	1.10E-11	3.00E-04	3.65E-08	7.83E-13		
Nickel	1.30E+02	2.04E-09	2.00E-02	1.02E-07	1.45E-10		
Silver	4.50E+00	7.05E-11	5.00E-03	1.41E-08	5.03E-12		
Thallium	1.30E+02	2.04E-09	8.00E-05	2.54E-05	1.45E-10		
Vanadium	2.50E+01	3.91E-10	7.00E-03	5.59E-08	2.80E-11		
PCBs/Pesticides							
4,4'-DDD	4.20E-02	6.58E-12			4.70E-13	2.40E-01	1.13E-13
Aroclor 1254	1.60E+00	2.50E-10	2.00E-05	1.25E-05	1.79E-11	1.00E+00	1.79E-11
Endosulfan II	7.10E-02	1.11E-11	6.00E-03	1.85E-09	7.94E-13		
gamma-Chlordane	2.30E-02	3.60E-12	6.00E-05	6.00E-08	2.57E-13	1.30E+00	3.34E-13
Semivolatile Organics							
1,2-Dichlorobenzene	2.20E-01	3.44E-11	9.00E-02	3.83E-10	2.46E-12		
1,4-Dichlorobenzene	7.50E-01	1.17E-10			8.39E-12	2.40E-02	2.01E-13
1-Chloronaphthalene	2.30E-01	3.60E-11	3.00E-02	1.20E-09	2.57E-12		
2-Chloronaphthalene	5.00E-01	7.83E-11	8.00E-02	9.78E-10	5.59E-12		
2-Methylnaphthalene	7.70E-01	1.21E-10	3.00E-02	4.02E-09	8.61E-12		
Acenaphthene	6.50E-01	1.02E-10	6.00E-02	1.70E-09	7.27E-12		
Anthracene	9.20E-01	1.44E-10	3.00E-01	4.80E-10	1.03E-11		
Benzo(a)anthracene	2.20E+00	3.44E-10			2.46E-11	7.30E-01	1.80E-11
Benzo(a)pyrene	2.30E+00	3.60E-10			2.57E-11	7.30E+00	1.88E-10
Benzo(b)fluoranthene	2.80E+00	4.38E-10	6.00E-02	7.31E-09	3.13E-11	7.30E-01	2.29E-11
Benzo(g,h,i)perylene	1.20E+00	1.88E-10	3.00E-02	6.26E-09	1.34E-11		
Benzo(k)fluoranthene	2.20E+00	3.44E-10			2.46E-11	7.30E-02	1.80E-12
Chrysene	3.00E+00	4.70E-10			3.35E-11	7.30E-03	2.45E-13
Di-n-butyl phthalate	3.00E-01	4.70E-11	1.00E-01	4.70E-10	3.35E-12		
Dibenz(a,h)anthracene	6.20E-01	9.71E-11			6.93E-12	7.30E+00	5.06E-11
Dibenzofuran	6.20E-01	9.71E-11	4.00E-03	2.43E-08	6.93E-12		
Fluoranthene	7.60E+00	1.19E-09	4.00E-02	2.97E-08	8.50E-11		
Fluorene	6.50E-01	1.02E-10	4.00E-02	2.54E-09	7.27E-12		
Indeno(1,2,3-cd)pyrene	1.20E+00	1.88E-10			1.34E-11	7.30E-01	9.80E-12
Naphthalene	9.60E-01	1.50E-10	3.00E-02	5.01E-09	1.07E-11		
Phenanthrene	4.30E+00	6.73E-10	3.00E-02	2.24E-08	4.81E-11		
Pyrene	4.60E+00	7.20E-10	3.00E-02	2.40E-08	5.14E-11		
bis(2-Ethylhexyl)phthalate	3.50E+00	5.48E-10	2.00E-02	2.74E-08	3.91E-11	1.40E-02	5.48E-13
VolatileOrganics							
2-Butanone (MEK)	3.60E-02	5.64E-12	6.00E-01	9.39E-12	4.03E-13		
Acetone	7.90E-02	1.24E-11	1.00E-01	1.24E-10	8.83E-13		
Carbon disulfide	9.20E-03	1.44E-12	1.00E-01	1.44E-11	1.03E-13		
Chlorobenzene	6.90E-01	1.08E-10	2.00E-02	5.40E-09	7.72E-12		
Chloromethane	2.50E-02	3.91E-12			2.80E-13	1.30E-02	3.63E-15
Ethylbenzene	8.10E-03	1.27E-12	1.00E-01	1.27E-11	9.06E-14		
Methylene chloride	1.30E-02	2.04E-12	6.00E-02	3.39E-11	1.45E-13	7.50E-03	1.09E-15
Styrene	1.70E-02	2.66E-12	2.00E-01	1.33E-11	1.90E-13		
Toluene	1.30E-02	2.04E-12	2.00E-01	1.02E-11	1.45E-13		
Xylenes (total)	6.10E-03	9.55E-13	2.00E+00	4.77E-13	6.82E-14		
			HAZARD INDEX =	4.08E-05		TOTAL CANCER RISK =	3.12E-10

NTF = No critical toxicity values; surrogate toxicity values are not available for these chemicals, therefore, they were not evaluated in the quantitative risk assessment

TABLE A-30

TINKER AFB SITE - ON-BASE EAST SOLDIER CREEK (AREA 3)
DERMAL EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER - RME
(FUTURE USE SCENARIO)

Equation: CDI = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT1 x AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
- CDI = Chronic Daily Intake
- CS = Concentration in Sediments
- CF = Conversion Factor (10^{-6} kg/mg)
- SA = Skin Surface Area Available for Contact = 9,800 cm^2
- AF = Dermal Soil Adherence Factor = 1.0 mg/cm^2
- ABS = Absorption Factor = 1.0% for organics and 0.1% for inorganics
- EF = Exposure Frequency = 5 days per year
- ED = Exposure Duration = 25 years
- BW = Body Weight = 70 kg
- AT1 = Days Per Year = 365 days
- AT2 = Averaging Time (70 years for cancer causing effects, 25 years for effects other than carcinogenicity)
- SF = Slope Factor
- RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Antimony	5.30E+00	1.02E-08	4.00E-04	2.54E-05	3.63E-09		
Beryllium	5.90E-01	1.13E-09	5.00E-03	2.26E-07	4.04E-10	4.30E+00	1.74E-09
Cadmium	4.60E+02	8.82E-07	1.00E-03	8.82E-04	3.15E-07		
Chromium	9.10E+02	1.75E-06	5.00E-03	3.49E-04	6.23E-07		
Cobalt	1.60E+01	3.07E-08	6.00E-02	5.11E-07	1.10E-08		
Lead	3.40E+02	6.52E-07	NTF		2.33E-07	NTF	
Mercury	1.10E+00	2.11E-09	3.00E-04	7.03E-06	7.53E-10		
Nickel	2.20E+02	4.22E-07	2.00E-02	2.11E-05	1.51E-07		
Silver	8.20E+00	1.57E-08	5.00E-03	3.15E-06	5.62E-09		
Thallium	1.30E+02	2.49E-07	8.00E-05	3.12E-03	8.90E-08		
Vanadium	3.00E+01	5.75E-08	7.00E-03	8.22E-06	2.05E-08		
Pesticides/PCBs							
4,4'-DDD	4.20E-02	8.05E-10			2.88E-10	2.40E-01	6.90E-11
Aroclor 1254	4.90E+00	9.40E-08	2.00E-05	4.70E-03	3.36E-08	2.00E+00	6.71E-08
Endosulfan II	9.30E-02	1.78E-09	6.00E-03	2.97E-07	6.37E-10		
gamma-Chlordane	2.30E-02	4.41E-10	6.00E-05	7.35E-06	1.58E-10	1.30E+00	2.05E-10
Semivolatile Organics							
1,2-Dichlorobenzene	2.20E-01	4.22E-09	9.00E-02	4.69E-08	1.51E-09		
1,4-Dichlorobenzene	1.10E+00	2.11E-09			7.53E-10	2.40E-02	1.81E-11
1-Chloronaphthalene	2.30E-01	4.41E-09	3.00E-02	1.47E-07	1.58E-09		
2-Chloronaphthalene	5.00E-01	9.59E-09	8.00E-02	1.20E-07	3.42E-09		
2-Methylnaphthalene	1.50E+00	2.88E-08	3.00E-02	9.59E-07	1.03E-08		
Acenaphthene	1.10E+00	2.11E-08	6.00E-02	3.52E-07	7.53E-09		
Anthracene	1.80E+00	3.45E-08	3.00E-01	1.15E-07	1.23E-08		
Benzo(a)anthracene	5.90E+00	1.13E-07			4.04E-08	7.30E-01	2.95E-08
Benzo(a)pyrene	6.10E+00	1.17E-07			4.18E-08	7.30E+00	3.05E-07
Benzo(b)fluoranthene	9.30E+00	1.78E-07	6.00E-02	2.97E-06	6.37E-08	7.30E-01	4.65E-08
Benzo(g,h,i)perylene	2.80E+00	5.37E-08	3.00E-02	1.79E-06	1.92E-08		
Benzo(k)fluoranthene	6.00E+00	1.15E-07			4.11E-08	7.30E-02	3.00E-09
Chrysene	9.40E+00	1.80E-07			6.44E-08	7.30E-03	4.70E-10
Di-n-butyl phthalate	3.00E-01	5.75E-09	1.00E-01	5.75E-08	2.05E-09		
Dibenz(a,h)anthracene	1.00E+00	1.92E-08			6.85E-09	7.30E+00	5.00E-08
Dibenzofuran	1.10E+00	2.11E-08	4.00E-03	5.27E-06	7.53E-09		
Fluoranthene	2.70E+01	5.18E-07	4.00E-02	1.29E-05	1.85E-07		
Fluorene	1.10E+00	2.11E-08	4.00E-02	5.27E-07	7.53E-09		
Indeno(1,2,3-cd)pyrene	2.40E+00	4.60E-08			1.64E-08	7.30E-01	1.20E-08
Naphthalene	2.20E+00	4.22E-08	3.00E-02	1.41E-06	1.51E-08		
Phenanthrene	1.50E+01	2.88E-07	3.00E-02	9.59E-06	1.03E-07		
Pyrene	1.70E+01	3.26E-07	3.00E-02	1.09E-05	1.16E-07		
bis(2-Ethylhexyl)phthalate	9.90E+00	1.90E-07	2.00E-02	9.49E-06	6.78E-08	1.40E-02	9.49E-10
Volatile Organics							
2-Butanone (MEK)	3.60E-02	6.90E-10	6.00E-01	1.15E-09	2.47E-10		
Acetone	1.50E-01	2.88E-09	1.00E-01	2.88E-08	1.03E-09		
Carbon disulfide	9.20E-03	1.76E-11	1.00E-01	1.76E-10	6.30E-12		
Chlorobenzene	6.90E-01	1.32E-08	2.00E-02	6.62E-07	4.71E-09		
Chloromethane	2.50E-02	4.79E-10			1.71E-10	1.30E-02	2.23E-12
Ethylbenzene	8.10E-03	1.55E-10	1.00E-01	1.55E-09	5.55E-11		
Methylene chloride	1.30E-02	2.49E-10	6.00E-02	4.16E-09	8.90E-11	7.50E-03	6.68E-13
Styrene	1.70E-02	3.26E-10	2.00E-01	1.63E-09	1.16E-10		
Toluene	1.30E-02	2.49E-11	2.00E-01	1.25E-10	8.90E-12		
Xylenes (total)	6.10E-03	1.17E-11	2.00E+00	5.85E-12	4.18E-12		
			HAZARD INDEX =	9.18E-03	TOTAL CANCER RISK =		5.17E-07

NTF = No critical toxicity values - surrogate toxicity values are not available for these chemicals, therefore, they were not evaluated in the quantitative risk assessment

TABLE A-31

TINKER AFB SITE - ON-BASE EAST SOLDIER CREEK (AREA 3)
INGESTION EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER - AVERAGE EXPOSURE
(FUTURE USE SCENARIO)

Equation CDI = (CS x CF x IR x EF x ED)/(BW x AT1 x AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CS = Concentration in Sediments
CF = Conversion Factor (10^{-6} kg/mg)
IR = Sediment Ingestion Rate = 10 mg/day
EF = Exposure Frequency = 1 day per year
ED = Exposure Duration = 5 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Average Time (70 years for cancer causing effects, 5 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Antimony	4.90E+00	1.92E-09	4.00E-04	4.79E-06	1.37E-10		
Beryllium	4.50E-01	1.76E-10	5.00E-03	3.52E-08	1.26E-11	4.30E+00	5.41E-11
Cadmium	5.80E+01	2.27E-08	1.00E-03	2.27E-05	1.62E-09		
Chromium	4.20E+02	1.64E-07	5.00E-03	3.29E-05	1.17E-08		
Cobalt	1.20E+01	4.70E-09	6.00E-02	7.83E-08	3.35E-10		
Lead	1.40E+02	5.48E-08	NTF		3.91E-09	NTF	
Mercury	7.00E-01	2.74E-10	3.00E-04	9.13E-07	1.96E-11		
Nickel	1.30E+02	5.09E-08	2.00E-02	2.54E-06	3.63E-09		
Silver	4.50E+00	1.76E-09	5.00E-03	3.52E-07	1.26E-10		
Thallium	1.30E+02	5.09E-08	8.00E-05	6.36E-04	3.63E-09		
Vanadium	2.50E+01	9.78E-09	7.00E-03	1.40E-06	6.99E-10		
Pesticides/PCBs							
4,4'-DDD	4.20E-02	1.64E-11			1.17E-12	2.40E-01	2.82E-13
Aroclor 1254	1.60E+00	6.26E-10	2.00E-05	3.13E-05	4.47E-11	1.00E+00	4.47E-11
Endosulfan II	7.10E-02	2.78E-11	6.00E-03	4.63E-09	1.98E-12		
gamma-Chlordane	2.30E-02	9.00E-12	6.00E-05	1.50E-07	6.43E-13	1.30E+00	8.36E-13
Semivolatile Organics							
1,2-Dichlorobenzene	2.20E-01	8.61E-11	9.00E-02	9.57E-10	6.15E-12		
1,4-Dichlorobenzene	7.50E-01	2.94E-10			2.10E-11	2.40E-02	5.03E-13
1-Chloronaphthalene	2.30E-01	9.00E-11	3.00E-02	3.00E-09	6.43E-12		
2-Chloronaphthalene	5.00E-01	1.96E-10	8.00E-02	2.45E-09	1.40E-11		
2-Methylnaphthalene	7.70E-01	3.01E-10	3.00E-02	1.00E-08	2.15E-11		
Acenaphthene	6.50E-01	2.54E-10	6.00E-02	4.24E-09	1.82E-11		
Anthracene	9.20E-01	3.60E-10	3.00E-01	1.20E-09	2.57E-11		
Benzo(a)anthracene	2.20E+00	8.61E-10			6.15E-11	7.30E-01	4.49E-11
Benzo(a)pyrene	2.30E+00	9.00E-10			6.43E-11	7.30E+00	4.69E-10
Benzo(b)fluoranthene	2.80E+00	1.10E-09	6.00E-02	1.83E-08	7.83E-11	7.30E-01	5.71E-11
Benzo(g,h,i)perylene	1.20E+00	4.70E-10	3.00E-02	1.57E-08	3.35E-11		
Benzo(k)fluoranthene	2.20E+00	8.61E-10			6.15E-11	7.30E-02	4.49E-12
Chrysene	3.00E+00	1.17E-09			8.39E-11	7.30E-03	6.12E-13
Di-n-butyl phthalate	3.00E-01	1.17E-10	1.00E-01	1.17E-09	8.39E-12		
Dibenz(a,h)anthracene	6.20E-01	2.43E-10			1.73E-11	7.30E+00	1.27E-10
Dibenzofuran	6.20E-01	2.43E-10	4.00E-03	6.07E-08	1.73E-11		
Fluoranthene	7.60E+00	2.97E-09	4.00E-02	7.44E-08	2.12E-10		
Fluorene	6.50E-01	2.54E-10	4.00E-02	6.36E-09	1.82E-11		
Indeno(1,2,3-cd)pyrene	1.20E+00	4.70E-10			3.35E-11	7.30E-01	2.45E-11
Naphthalene	9.60E-01	3.76E-10	3.00E-02	1.25E-08	2.68E-11		
Phenanthrene	4.30E+00	1.68E-09	3.00E-02	5.61E-08	1.20E-10		
Pyrene	4.60E+00	1.80E-09	3.00E-02	6.00E-08	1.29E-10		
bis(2-Ethylhexyl)phthalate	3.50E+00	1.37E-09	2.00E-02	6.85E-08	9.78E-11	1.40E-02	1.37E-12
Volatile Organics							
2-Butanone (MEK)	3.60E-02	1.41E-11	6.00E-01	2.35E-11	1.01E-12		
Acetone	7.90E-02	3.09E-11	1.00E-01	3.09E-10	2.21E-12		
Carbon disulfide	9.20E-03	3.60E-12	1.00E-01	3.60E-11	2.57E-13		
Chlorobenzene	6.90E-01	2.70E-10	2.00E-02	1.35E-08	1.93E-11		
Chloromethane	2.50E-02	9.78E-12			6.99E-13	1.30E-02	9.09E-15
Ethylbenzene	8.10E-03	3.17E-12	1.00E-01	3.17E-11	2.26E-13		
Methylene chloride	1.30E-02	5.09E-12	6.00E-02	8.48E-11	3.63E-13	7.50E-03	2.73E-15
Styrene	1.70E-02	6.65E-12	2.00E-01	3.33E-11	4.75E-13		
Toluene	1.30E-02	5.09E-12	2.00E-01	2.54E-11	3.63E-13		
Xylenes (total)	6.10E-03	2.39E-12	2.00E+00	1.19E-12	1.71E-13		
			HAZARD INDEX =	2.34E-04	TOTAL CANCER RISK =		8.29E-10

NTF = No critical toxicity values. surrogate toxicity values are not available for these chemicals, therefore, they were not evaluated in the quantitative risk assessment

TABLE A-32

TINKER AFB SITE - ON-BASE EAST SOLDIER CREEK (AREA 3)
INGESTION EXPOSURE TO CHEMICALS IN SEDIMENTS
ON-BASE CONSTRUCTION WORKER - RME
(FUTURE USE SCENARIO)

Equation: CDI = (CS x CF x IR x EF x ED)/(BW x AT1 x AT2)
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
CDI = Chronic Daily Intake
CS = Concentration in Sediments
CF = Conversion Factor (10^{-6} kg/mg)
IR = Sediment Ingestion Rate = 50 mg/day
EF = Exposure Frequency = 5 days per year
ED = Exposure Duration = 25 years
BW = Body Weight = 70 kg
AT1 = Days Per Year = 365 days
AT2 = Average Time (70 years for cancer causing effects, 25 years for effects other than carcinogenicity)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals							
Antimony	5.30E+00	5.19E-08	4.00E-04	1.30E-04	1.85E-08		
Beryllium	5.90E-01	5.77E-09	5.00E-03	1.15E-06	2.06E-09	4.30E+00	8.87E-09
Cadmium	4.60E+02	4.50E-06	1.00E-03	4.50E-03	1.61E-06		
Chromium	9.10E+02	8.90E-06	5.00E-03	1.78E-03	3.18E-06		
Cobalt	1.60E+01	1.57E-07	6.00E-02	2.61E-06	5.59E-08		
Lead	3.40E+02	3.33E-06	NTF		1.19E-06	NTF	
Mercury	1.10E+00	1.08E-08	3.00E-04	3.59E-05	3.84E-09		
Nickel	2.20E+02	2.15E-06	2.00E-02	1.08E-04	7.69E-07		
Silver	8.20E+00	8.02E-08	5.00E-03	1.60E-05	2.87E-08		
Thallium	1.30E+02	1.27E-06	8.00E-05	1.59E-02	4.54E-07		
Vanadium	3.00E+01	2.94E-07	7.00E-03	4.19E-05	1.05E-07		
Pesticides/PCBs							
4,4'-DDD	4.20E-02	4.11E-10			1.47E-10	2.40E-01	3.52E-11
Aroclor 1254	4.90E+00	4.79E-08	2.00E-05	2.40E-03	1.71E-08	2.00E+00	3.42E-08
Endosulfan II	9.30E-02	9.10E-10	6.00E-03	1.52E-07	3.25E-10		
gamma-Chlordane	2.30E-02	2.25E-10	6.00E-05	3.75E-06	8.04E-11	1.30E+00	1.04E-10
Semivolatile Organics							
1,2-Dichlorobenzene	2.20E-01	2.15E-09	9.00E-02	2.39E-08	7.69E-10		
1,4-Dichlorobenzene	1.10E+00	1.08E-08			3.84E-09	2.40E-02	9.23E-11
1-Chloronaphthalene	2.30E-01	2.25E-09	3.00E-02	7.50E-08	8.04E-10		
2-Chloronaphthalene	5.00E-01	4.89E-09	8.00E-02	6.12E-08	1.75E-09		
2-Methylnaphthalene	1.50E+00	1.47E-08	3.00E-02	4.89E-07	5.24E-09		
Acenaphthene	1.10E+00	1.08E-08	6.00E-02	1.79E-07	3.84E-09		
Anthracene	1.80E+00	1.76E-08	3.00E-01	5.87E-08	6.29E-09		
Benzo(a)anthracene	5.90E+00	5.77E-08			2.06E-08	7.30E-01	1.51E-08
Benzo(a)pyrene	6.10E+00	5.97E-08			2.13E-08	7.30E+00	1.56E-07
Benzo(b)fluoranthene	9.30E+00	9.10E-08	6.00E-02	1.52E-06	3.25E-08	7.30E-01	2.37E-08
Benzo(g,h,i)perylene	2.80E+00	2.74E-08	3.00E-02	9.13E-07	9.78E-09		
Benzo(k)fluoranthene	6.00E+00	5.87E-08			2.10E-08	7.30E-02	1.53E-09
Chrysene	9.40E+00	9.20E-08			3.28E-08	7.30E-03	2.40E-10
Di-n-butyl phthalate	3.00E-01	2.94E-09	1.00E-01	2.94E-08	1.05E-09		
Dibenz(a,h)anthracene	1.00E+00	9.78E-09			3.49E-09	7.30E+00	2.55E-08
Dibenzofuran	1.10E+00	1.08E-08	4.00E-03	2.69E-06	3.84E-09		
Fluoranthene	2.70E+01	2.64E-07	4.00E-02	6.60E-06	9.44E-08		
Fluorene	1.10E+00	1.08E-08	4.00E-02	2.69E-07	3.84E-09		
Indeno(1,2,3-cd)pyrene	2.40E+00	2.35E-08			8.39E-09	7.30E-01	6.12E-09
Naphthalene	2.20E+00	2.15E-08	3.00E-02	7.18E-07	7.69E-09		
Phenanthrene	1.50E+01	1.47E-07	3.00E-02	4.89E-06	5.24E-08		
Pyrene	1.70E+01	1.66E-07	3.00E-02	5.54E-06	5.94E-08		
bis(2-Ethylhexyl)phthalate	9.90E+00	9.69E-08	2.00E-02	4.84E-06	3.46E-08	1.40E-02	4.84E-10
VolatileOrganics							
2-Butanone (MEK)	3.60E-02	3.52E-10	6.00E-01	5.87E-10	1.26E-10		
Acetone	1.50E-01	1.47E-09	1.00E-01	1.47E-08	5.24E-10		
Carbon disulfide	9.20E-03	9.00E-11	1.00E-01	9.00E-10	3.21E-11		
Chlorobenzene	6.90E-01	6.75E-09	2.00E-02	3.38E-07	2.41E-09		
Chloromethane	2.50E-02	2.45E-10			8.74E-11	1.30E-02	1.14E-12
Ethylbenzene	8.10E-03	7.93E-11	1.00E-01	7.93E-10	2.83E-11		
Methylene chloride	1.30E-02	1.27E-10	6.00E-02	2.12E-09	4.54E-11	7.50E-03	3.41E-13
Styrene	1.70E-02	1.66E-10	2.00E-01	8.32E-10	5.94E-11		
Toluene	1.30E-02	1.27E-10	2.00E-01	6.36E-10	4.54E-11		
Xylenes (total)	6.10E-03	5.97E-11	2.00E+00	2.98E-11	2.13E-11		
			HAZARD INDEX =	2.49E-02	TOTAL CANCER RISK =		2.72E-07

NTF = No critical toxicity values. surrogate toxicity values are not available for these chemicals, therefore, they were not evaluated in the quantitative risk assessment

AREA 4
OFF-BASE EAST SOLDIER CREEK

TABLE A-33

TINKER AFB SITE - OFF-BASE EAST SOLDIER CREEK (AREA 4)
INCIDENTAL INGESTION OF CHEMICALS IN SURFACE WATER DUE TO WADING AND SWIMMING
OFF-BASE CHILD AND ADULT RESIDENT - AVERAGE EXPOSURE
(CURRENT AND FUTURE USE SCENARIO)

Equation : HIF = [(IRc x ETc x EFc x EDc) / BWc + (IRa x ETa x EFa x EDa) / BWa] / (AT1 x AT2)
CDI = CW x HIF
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
HIF = Human Intake Factor
CDI = Chronic Daily Intake
CW = Concentration in Surface Water
IRc = Child Ingestion Rate = 0.025 L/hour
ETc = Child Exposure Time = 3 hours/day
EFc = Child Exposure Frequency = 17 days per year
EDc = Child Exposure Duration = 5 years
BWc = Child Body Weight = 15.1 kg
IRa = Adult Ingestion Rate = 0.0025 L/hour
ETa = Adult Exposure Time = 1 hour /day
EFa = Adult Exposure Frequency = 2 days per year
EDa = Adult Exposure Duration = 9 years
BW = Adult Body Weight = 57.1 kg
AT1 = Days Per Year = 365 days/year
AT2 = Averaging Time (70 years for carcinogenic effects, 14 years for noncarcinogenic effects)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	NON-CANCER HIF (L/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (L/kg-dy)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals									
Antimony	2.90E-04	8.28E-05	2.40E-08	4.00E-04	6.00E-05	1.66E-05	4.80E-09		
Arsenic	2.50E-03	8.28E-05	2.07E-07	3.00E-04	6.90E-04	1.66E-05	4.14E-08	1.50E+00	6.21E-08
Cadmium	9.50E-04	8.28E-05	7.86E-08	5.00E-04	1.57E-04	1.66E-05	1.57E-08		
Cobalt	3.60E-04	8.28E-05	2.98E-08	6.00E-02	4.97E-07	1.66E-05	5.96E-09		
Nickel	9.50E-03	8.28E-05	7.86E-07	2.00E-02	3.93E-05	1.66E-05	1.57E-07		
Vanadium	1.20E-02	8.28E-05	9.93E-07	7.00E-03	1.42E-04	1.66E-05	1.99E-07		
Semivolatile Organics									
bis(2-Ethylhexyl)phthalate	4.80E-03	8.28E-05	3.97E-07	2.00E-02	1.99E-05	1.66E-05	7.95E-08	1.40E-02	1.11E-09
Volatile Organics									
Acetone	4.10E-03	8.28E-05	3.39E-07	1.00E-02	3.39E-05	1.66E-05	6.79E-08		
					HAZARD INDEX =	1.14E-03		TOTAL CANCER RISK =	6.32E-08

TABLE A-34

TINKER AFB SITE - OFF-BASE EAST SOLDIER CREEK (AREA 4)
INCIDENTAL INGESTION OF CHEMICALS IN SURFACE WATER DUE TO WADING AND SWIMMING
OFF-BASE CHILD AND ADULT RESIDENT - RME
(CURRENT AND FUTURE USE SCENARIO)

Equation : HIF = [(IRc x ETc x EFc x EDc) / BWc + (IRa x ETa x EFa x EDa) / BWa] / (AT1 x AT2)
CDI = CW x HIF
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
HIF = Human Intake Factor
CDI = Chronic Daily Intake
CW = Concentration in Surface Water
IRc = Child Ingestion Rate = 0.05 L/hour
ETc = Child Exposure Time = 6 hours/day
EFc = Child Exposure Frequency = 34 days per year
EDc = Child Exposure Duration = 5 years
BWc = Child Body Weight = 15.1 kg
IRa = Adult Ingestion Rate = 0.005 L/hour
ETa = Adult Exposure Time = 2 hour /day
EFa = Adult Exposure Frequency = 4 days per year
EDa = Adult Exposure Duration = 25 years
BW = Adult Body Weight = 57.1 kg
AT1 = Days Per Year = 365 days/year
AT2 = Averaging Time (70 years for carcinogenic effects, 30 years for noncarcinogenic effects)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	NON-CANCER HIF (L/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (L/kg-dy)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals									
Antimony	2.90E-04	3.10E-04	8.99E-08	4.00E-04	2.25E-04	1.33E-04	3.85E-08		
Arsenic	2.80E-03	3.10E-04	8.68E-07	3.00E-04	2.89E-03	1.33E-04	3.72E-07	1.50E+00	5.58E-07
Cadmium	1.30E-03	3.10E-04	4.03E-07	5.00E-04	8.06E-04	1.33E-04	1.73E-07		
Cobalt	4.00E-04	3.10E-04	1.24E-07	6.00E-02	2.07E-06	1.33E-04	5.32E-08		
Nickel	1.20E-02	3.10E-04	3.72E-06	2.00E-02	1.86E-04	1.33E-04	1.59E-06		
Vanadium	1.60E-02	3.10E-04	4.96E-06	7.00E-03	7.09E-04	1.33E-04	2.13E-06		
Semivolatile Organics									
bis(2-Ethylhexyl)phthalate	5.00E-03	3.10E-04	1.55E-06	2.00E-02	7.75E-05	1.33E-04	6.64E-07	1.40E-02	9.30E-09
Volatile Organics									
Acetone	4.10E-03	3.10E-04	1.27E-06	1.00E-02	1.27E-04	1.33E-04	5.45E-07		

HAZARD INDEX = 5.03E-03 TOTAL CANCER RISK = 5.67E-07

TABLE A-35

TINKER AFB SITE - OFF-BASE EAST SOLDIER CREEK (AREA 4)
DERMAL EXPOSURE TO CHEMICALS IN SURFACE WATER DUE TO WADING AND SWIMMING
OFF-BASE CHILD AND ADULT RESIDENT - AVERAGE EXPOSURE
(CURRENT AND FUTURE USE SCENARIO)

Equation : HIF ={ [(SAc x ETc x EFc x EDc) / BWc + (SAa x ETa x EFa x EDa) / BWa] / (AT1 x AT2)} x CF
CDI = CW x PC x HIF
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where: HIF = Human Intake Factor
CDI = Chronic Daily Intake
CW = Concentration in Surface Water
PC = Chemical-specific Dermal Permeability Constant
SAc = Child Skin Surface Area Available for Contact = 1,800 cm^2
ETc = Child Exposure Time = 3 hours/day
EFc = Child Exposure Frequency = 17 days per year
EDc = Child Exposure Duration = 5 years
BWc = Child Body Weight = 15.1 kg
SAa = Adult Skin Surface Area Available for Contact = 2,800 cm^2
ETa = Adult Exposure Time = 1 hour /day
EFa = Adult Exposure Frequency = 2 days per year
EDa = Adult Exposure Duration = 9 years
BW = Adult Body Weight = 57.1 kg
CF = Conversion Factor (1L/1000cm^2)
AT1 = Days Per Year = 365 days/year
AT2 = Averaging Time (70 years for carcinogenic effects, 14 years for noncarcinogenic effects)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	PCa (cm/hr)	NON-CANCER HIF (L/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (L/kg-dy)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals										
Antimony	2.90E-04	0.001	2.17E-02	6.28E-09	4.00E-04	1.57E-05	4.33E-03	1.26E-09		
Arsenic	2.50E-03	0.001	2.17E-02	5.41E-08	3.00E-04	1.80E-04	4.33E-03	1.08E-08	1.50E+00	1.62E-08
Cadmium	9.50E-04	0.001	2.17E-02	2.06E-08	5.00E-04	4.11E-05	4.33E-03	4.11E-09		
Cobalt	3.60E-04	0.001	2.17E-02	7.80E-09	6.00E-02	1.30E-07	4.33E-03	1.56E-09		
Nickel	9.50E-03	0.001	2.17E-02	2.06E-07	2.00E-02	1.03E-05	4.33E-03	4.11E-08		
Vanadium	1.20E-02	0.001	2.17E-02	2.60E-07	7.00E-03	3.71E-05	4.33E-03	5.20E-08		
Semivolatile Organics										
bis(2-Ethylhexyl)phthalate	4.80E-03	0.032	2.17E-02	3.33E-06	2.00E-02	1.66E-04	4.33E-03	6.65E-07	1.40E-02	9.31E-09
Volatile Organics										
Acetone	4.10E-03									
					HAZARD INDEX =	4.51E-04			TOTAL CANCER RISK =	2.56E-08

Note
a Due to the volatility, volatile organics are assumed not available for dermal absorption

TABLE A-36

TINKER AFB SITE - OFF-BASE EAST SOLDIER CREEK (AREA 4)
DERMAL EXPOSURE TO CHEMICALS IN SURFACE WATER DUE TO WADING AND SWIMMING
OFF-BASE CHILD AND ADULT RESIDENT - RME
(CURRENT AND FUTURE USE SCENARIO)

Equation : HIF ={ [(SAc x ETc x EFc x EDc) / BWc + (SAa x ETa x EFa x EDa) / BWa] / (AT1 x AT2)} x CF
CDI = CW x PC x HIF
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
HIF = Human Intake Factor
CDI = Chronic Daily Intake
CW = Concentration in Surface Water
PC = Chemical-specific Dermal Permeability Constant
SAc = Child Skin Surface Area Available for Contact = 6,500 cm^2
ETc = Child Exposure Time = 6 hours/day
EFc = Child Exposure Frequency = 34 days per year
EDc = Child Exposure Duration = 5 years
BWc = Child Body Weight = 15.1 kg
SAa = Adult Skin Surface Area Available for Contact = 8,620 cm^2
ETa = Adult Exposure Time = 2 hour /day
EFa = Adult Exposure Frequency = 4 days per year
EDa = Adult Exposure Duration = 25 years
BW = Adult Body Weight = 57.1 kg
CF = Conversion Factor (1L/1000cm^2)
AT1 = Days Per Year = 365 days/year
AT2 = Averaging Time (70 years for carcinogenic effects, 30 years for noncarcinogenic effects)
SF = Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CW (mg/L)	PC[a] (cm/hr)	NON-CANCER HIF (L/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (L/kg-dy)	CANCER CDI (mg/kg-dy)	SF $(mg/kg-dy)^{-1}$	CANCER RISK (unitless)
Metals										
Antimony	2.90E-04	1.00E-03	4.29E-02	1.24E-08	4.00E-04	3.11E-05	1.84E-02	5.33E-09		
Arsenic	2.80E-03	1.00E-03	4.29E-02	1.20E-07	3.00E-04	4.00E-04	1.84E-02	5.14E-08	1.50E+00	7.71E-08
Cadmium	1.30E-03	1.00E-03	4.29E-02	5.57E-08	5.00E-04	1.11E-04	1.84E-02	2.39E-08		
Cobalt	4.00E-04	1.00E-03	4.29E-02	1.71E-08	6.00E-02	2.86E-07	1.84E-02	7.35E-09		
Nickel	1.20E-02	1.00E-03	4.29E-02	5.14E-07	2.00E-02	2.57E-05	1.84E-02	2.20E-07		
Vanadium	1.60E-02	1.00E-03	4.29E-02	6.86E-07	7.00E-03	9.80E-05	1.84E-02	2.94E-07		
Semivolatile Organics										
bis(2-Ethylhexyl)phthalate	5.00E-03	3.20E-02	4.29E-02	6.86E-06	2.00E-02	3.43E-04	1.84E-02	2.94E-06	1.40E-02	4.11E-08
Volatile Organics										
Acetone	4.10E-03									
					HAZARD INDEX =	1.01E-03			TOTAL CANCER RISK =	1.18E-07

Note:
a. Due to the volatility, volatile organics are assumed not available for dermal absorption.

TABLE A-37

TINKER AFB SITE - OFF-BASE EAST SOLDIER CREEK (AREA 4)
INCIDENTAL INGESTION EXPOSURE TO CHEMICALS IN SEDIMENTS DUE TO WADING AND SWIMMING
OFF-BASE CHILD AND ADULT RESIDENT - AVERAGE EXPOSURE
(CURRENT AND FUTURE USE SCENARIO)

Equation : **HIF = {[(IRc x EFc x EDc) / BWc + (IRa x EFa x EDa) / BWa] x CF}/ (AT1x AT2)**
CDI = CS x HIF
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
HIF= Human Intake Factor
CDI= Chronic Daily Intake
CS= Concentration in Sediments
IRc= Child Ingestion Rate = 100 mg/day
EFc= Child Exposure Frequency = 17 days per year
EDc= Child Exposure Duration = 5 years
BWc= Child Body Weight = 15.1 kg
IRa= Adult Ingestion Rate = 10 mg/day
EFa= Adult Exposure Frequency = 2 days per year
EDa= Adult Exposure Duration = 9 years
BWa= Adult Body Weight = 57.1 kg
AT1= Days Per Year = 365 days/year
AT2= Averaging Time (70 years for carcinogenic effects, 14 years for noncarcinogenic effects)
CF= Conversion Factor = 0.000001 kg/mg
SF= Slope Factor
RfD= Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER HIF (mg/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (mg/kg-dy)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals									
Antimony	4.20E+00	1.11E-07	4.65E-07	4.00E-04	1.16E-03	2.22E-08	9.31E-08		
Beryllium	3.60E-01	1.11E-07	3.99E-08	5.00E-03	7.98E-06	2.22E-08	7.98E-09	4.30E+00	3.43E-08
Cadmium	7.50E+00	1.11E-07	8.31E-07	1.00E-03	8.31E-04	2.22E-08	1.66E-07		
Cobalt	4.70E+00	1.11E-07	5.21E-07	6.00E-02	8.68E-06	2.22E-08	1.04E-07		
Mercury	4.90E-02	1.11E-07	5.43E-09	3.00E-04	1.81E-05	2.22E-08	1.09E-09		
Thallium	7.10E+01	1.11E-07	7.87E-06	8.00E-05	9.83E-02	2.22E-08	1.57E-06		
Vanadium	1.70E+01	1.11E-07	1.88E-06	7.00E-03	2.69E-04	2.22E-08	3.77E-07		
Pesticides/PCBs									
Dieldrin	2.10E-03	1.11E-07	2.33E-10	5.00E-05	4.65E-06	2.22E-08	4.65E-11	1.60E+01	7.44E-10
Endosulfan II	2.10E-03	1.11E-07	2.33E-10	6.00E-03	3.88E-08	2.22E-08	4.65E-11		
Semivolatile Organics									
1,4-Dichlorobenzene	4.20E-02	1.11E-07	4.65E-09			2.22E-08	9.31E-10	2.40E-02	2.23E-11
1-Chloronaphthalene	4.90E-02	1.11E-07	5.43E-09	3.00E-02	1.81E-07	2.22E-08	1.09E-09		
2-Methylnaphthalene	1.30E-01	1.11E-07	1.44E-08	3.00E-02	4.80E-07	2.22E-08	2.88E-09		
Benzo(b)fluoranthene	4.00E-02	1.11E-07	4.43E-09			2.22E-08	8.86E-10	7.30E-01	6.47E-10
Chrysene	4.70E-02	1.11E-07	5.21E-09			2.22E-08	1.04E-09	7.30E-03	7.60E-12
Fluoranthene	3.10E-01	1.11E-07	3.43E-08	4.00E-02	8.59E-07	2.22E-08	6.87E-09		
Isophorone	4.10E-01	1.11E-07	4.54E-08	2.00E-01	2.27E-07	2.22E-08	9.08E-09	9.50E-04	8.63E-12
Phenanthrene	6.40E-02	1.11E-07	7.09E-09	3.00E-02	2.36E-07	2.22E-08	1.42E-09		
Pyrene	1.90E-01	1.11E-07	2.10E-08	3.00E-02	7.02E-07	2.22E-08	4.21E-09		
bis(2-Ethylhexyl)phthalate	1.40E+00	1.11E-07	1.55E-07	2.00E-02	7.75E-06	2.22E-08	3.10E-08	1.40E-02	4.34E-10
Volatile Organics									
2-Butanone (MEK)	6.00E-03	1.11E-07	6.65E-10	6.00E-01	1.11E-09	2.22E-08	1.33E-10		
Acetone	1.20E-02	1.11E-07	1.33E-09	1.00E-01	1.33E-08	2.22E-08	2.66E-10		
Carbon disulfide	3.10E-03	1.11E-07	3.43E-10	1.00E-01	3.43E-09	2.22E-08	6.87E-11		
Chlorobenzene	2.10E-02	1.11E-07	2.33E-09	2.00E-02	1.16E-07	2.22E-08	4.65E-10		
Methylene chloride	2.10E-03	1.11E-07	2.33E-10	6.00E-02	3.88E-09	2.22E-08	4.65E-11	7.50E-03	3.49E-13
				HAZARD INDEX =	1.01E-01			TOTAL CANCER RISK =	3.62E-08

TABLE A-38

TINKER AFB SITE - OFF-BASE EAST SOLDIER CREEK (AREA 4)
INCIDENTAL INGESTION EXPOSURE TO CHEMICALS IN SEDIMENTS DUE TO WADING AND SWIMMING
OFF-BASE CHILD AND ADULT RESIDENT - RME
(CURRENT AND FUTURE USE SCENARIO)

Equation HIF = {[(IRc x EFc x EDc) / BWc + (IRa x EFa x EDa) / BWa] x CF}/ (AT1x AT2)
CDI = CS x HIF
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
HIF= Human Intake Factor
CDI= Chronic Daily Intake
CS= Concentration in Sediments
IRc= Child Ingestion Rate = 100mg/day
EFc= Child Exposure Frequency = 17 days per year
EDc= Child Exposure Duration = 5 years
BWc= Child Body Weight = 15.1 kg
IRa= Adult Ingestion Rate = 10mg/day
EFa= Adult Exposure Frequency = 2 days per year
EDa= Adult Exposure Duration = 25 years
BWa= Adult Body Weight = 57.1 kg
AT1= Days Per Year = 365 days/year
AT2= Averaging Time (70 years for carcinogenic effects, 30 years for noncarcinogenic effects)
CF= Conversion Factor = 0.000001 kg/mg
SF= Slope Factor
RfD= Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER HIF (mg/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (mg/kg-dy)	CANCER CDI (mg/kg-dy)	SF (mg/kg-dy)-1	CANCER RISK (unitless)
Metals									
Antimony	4.80E+00	2.22E-07	1.06E-06	4.00E-04	2.66E-03	9.50E-08	4.56E-07		
Beryllium	6.70E-01	2.22E-07	1.48E-07	5.00E-03	2.97E-05	9.50E-08	6.36E-08	4.30E+00	2.74E-07
Cadmium	2.50E+01	2.22E-07	5.54E-06	1.00E-03	5.54E-03	9.50E-08	2.37E-06		
Cobalt	8.10E+00	2.22E-07	1.80E-06	6.00E-02	2.99E-05	9.50E-08	7.69E-07		
Mercury	9.40E-02	2.22E-07	2.08E-08	3.00E-04	6.94E-05	9.50E-08	8.93E-09		
Thallium	1.30E+02	2.22E-07	2.88E-05	8.00E-05	3.60E-01	9.50E-08	1.23E-05		
Vanadium	2.70E+01	2.22E-07	5.98E-06	7.00E-03	8.55E-04	9.50E-08	2.56E-06		
Pesticides/PCBs									
Dieldrin	2.10E-03	2.22E-07	4.65E-10	5.00E-05	9.31E-06	9.50E-08	1.99E-10	1.60E+01	3.19E-09
Endosulfan II	2.10E-03	2.22E-07	4.65E-10	6.00E-03	7.76E-08	9.50E-08	1.99E-10		
Semivolatile Organics									
1,4-Dichlorobenzene	4.20E-02	2.22E-07	9.31E-09			9.50E-08	3.99E-09	2.40E-02	9.57E-11
1-Chloronaphthalene	4.90E-02	2.22E-07	1.09E-08	3.00E-02	3.62E-07	9.50E-08	4.65E-09		
2-Methylnaphthalene	1.30E-01	2.22E-07	2.88E-08	3.00E-02	9.60E-07	9.50E-08	1.23E-08		
Benzo(b)fluoranthene	4.00E-02	2.22E-07	8.86E-09			9.50E-08	3.80E-09	7.30E-01	2.77E-09
Chrysene	4.70E-02	2.22E-07	1.04E-08			9.50E-08	4.46E-09	7.30E-03	3.26E-11
Fluoranthene	5.90E-01	2.22E-07	1.31E-07	4.00E-02	3.27E-06	9.50E-08	5.60E-08		
Isophorone	4.70E-01	2.22E-07	1.04E-07	2.00E-01	5.21E-07	9.50E-08	4.46E-08	9.50E-04	4.24E-11
Phenanthrene	6.40E-02	2.22E-07	1.42E-08	3.00E-02	4.73E-07	9.50E-08	6.08E-09		
Pyrene	2.60E-01	2.22E-07	5.76E-08	3.00E-02	1.92E-06	9.50E-08	2.47E-08		
bis(2-Ethylhexyl)phthalate	5.20E+00	2.22E-07	1.15E-06	2.00E-02	5.76E-05	9.50E-08	4.94E-07	1.40E-02	6.91E-09
Volatile Organics									
2-Butanone (MEK)	7.00E-03	2.22E-07	1.55E-09	6.00E-01	2.59E-09	9.50E-08	6.65E-10		
Acetone	1.90E-02	2.22E-07	4.21E-09	1.00E-01	4.21E-08	9.50E-08	1.80E-09		
Carbon disulfide	4.00E-03	2.22E-07	8.86E-10	1.00E-01	8.86E-09	9.50E-08	3.80E-10		
Chlorobenzene	1.10E-01	2.22E-07	2.44E-08	2.00E-02	1.22E-06	9.50E-08	1.04E-08		
Methylene chloride	2.10E-03	2.22E-07	4.65E-10	6.00E-02	7.76E-09	9.50E-08	1.99E-10	7.50E-03	1.50E-12
					HAZARD INDEX =	3.69E-01		TOTAL CANCER RISK =	2.87E-07

TABLE A-39

TINKER AFB SITE - OFF-BASE EAST SOLDIER CREEK (AREA 4)
DERMAL EXPOSURE TO CHEMICALS IN SEDIMENTS DUE TO WADING AND SWIMMING
OFF-BASE CHILD AND ADULT RESIDENT - AVERAGE EXPOSURE
(CURRENT AND FUTURE USE SCENARIO)

Equation: HIF = {[(SAc x EFc x EDc x ABS) / BWc + (SAa x EFa x EDa x ABS) / BWa] x CF} / (AT1 x AT2)
CDI = CS x AF x HIF
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
HIF= Human Intake Factor
CDI= Chronic Daily Intake
CS= Concentration in Sediments
SAc= Child Skin Surface Area Available for Contact = 6,500 cm^2
EFc= Child Exposure Frequency = 17 days per year
EDc= Child Exposure Duration = 5 years
BWc= Child Body Weight = 15.1 kg
SAa= Adult Skin Surface Area Available for Contact = 2,800 cm^2
EFa= Adult Exposure Frequency = 2 days per year
EDa= Adult Exposure Duration = 9 years
BWa= AdultBody Weight = 57.1 kg
AF= Adherence Factor = 1.0% for organics and 0.1% for inorganics
ABS= Absorption Factor = 0.2
AT1= Days Per Year = 365 days/year
AT2= Averaging Time (70 years for carcinogenic effects, 14 years for noncarcinogenic effects)
CF= Conversion Factor = 0.000001 kg/mg
SF= Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER HIF (mg/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (mg/kg-dy)	CANCER CDI (mg/kg-dy)	SF $(mg/kg\text{-}dy)^{-1}$	CANCER RISK (unitless)
Metals									
Antimony	4.20E+00	7.33E-09	6.16E-09	4.00E-04	1.54E-05	1.47E-09	1.23E-09		
Beryllium	3.60E-01	7.33E-09	5.28E-10	5.00E-03	1.06E-07	1.47E-09	1.06E-10	4.30E+00	4.54E-10
Cadmium	7.50E+00	7.33E-09	1.10E-08	1.00E-03	1.10E-05	1.47E-09	2.20E-09		
Cobalt	4.70E+00	7.33E-09	6.89E-09	6.00E-02	1.15E-07	1.47E-09	1.38E-09		
Mercury	4.90E-02	7.33E-09	7.19E-11	3.00E-04	2.40E-07	1.47E-09	1.44E-11		
Thallium	7.10E+01	7.33E-09	1.04E-07	8.00E-05	1.30E-03	1.47E-09	2.08E-08		
Vanadium	1.70E+01	7.33E-09	2.49E-08	7.00E-03	3.56E-06	1.47E-09	4.99E-09		
Pesticides/PCBs									
Dieldrin	2.10E-03	7.33E-08	3.08E-11	5.00E-05	6.16E-07	1.47E-08	6.16E-12	1.60E+01	9.86E-11
Endosulfan II	2.10E-03	7.33E-08	3.08E-11	6.00E-03	5.13E-09	1.47E-08	6.16E-12		
Semivolatile Organics									
1,4-Dichlorobenzene	4.20E-02	7.33E-08	6.16E-10			1.47E-08	1.23E-10	2.40E-02	2.96E-12
1-Chloronaphthalene	4.90E-02	7.33E-09	7.19E-11	3.00E-02	2.40E-09	1.47E-09	1.44E-11		
2-Methylnaphthalene	1.30E-01	7.33E-08	1.91E-09	3.00E-02	6.36E-08	1.47E-08	3.81E-10		
Benzo(b)fluoranthene	4.00E-02	7.33E-08	5.87E-10			1.47E-08	1.17E-10	7.30E-01	8.57E-11
Chrysene	4.70E-02	7.33E-08	6.89E-10			1.47E-08	1.38E-10	7.30E-03	1.01E-12
Fluoranthene	3.10E-01	7.33E-08	4.55E-09	4.00E-02	1.14E-07	1.47E-08	9.09E-10		
Isophorone	4.10E-01	7.33E-08	6.01E-09	2.00E-01	3.01E-08	1.47E-08	1.20E-09	9.50E-04	1.14E-12
Phenanthrene	6.40E-02	7.33E-08	9.39E-10	3.00E-02	3.13E-08	1.47E-08	1.88E-10		
Pyrene	1.90E-01	7.33E-08	2.79E-09	3.00E-02	9.29E-08	1.47E-08	5.57E-10		
bis(2-Ethylhexyl)phthalate	1.40E+00	7.33E-08	2.05E-08	2.00E-02	1.03E-06	1.47E-08	4.11E-09	1.40E-02	5.75E-11
Volatile Organics									
2-Butanone (MEK)	6.00E-03	7.33E-08	8.80E-11	6.00E-01	1.47E-10	1.47E-08	1.76E-11		
Acetone	1.20E-02	7.33E-08	1.76E-10	1.00E-01	1.76E-09	1.47E-08	3.52E-11		
Carbon disulfide	3.10E-03	7.33E-08	4.55E-11	1.00E-01	4.55E-10	1.47E-08	9.09E-12		
Chlorobenzene	2.10E-02	7.33E-08	3.08E-10	2.00E-02	1.54E-08	1.47E-08	6.16E-11		
Methylene chloride	2.10E-03	7.33E-08	3.08E-11	6.00E-02	5.13E-10	1.47E-08	6.16E-12	7.50E-03	4.62E-14
					HAZARD INDEX =	1.33E-03		TOTAL CANCER RISK =	7.01E-10

TABLE A-40

TINKER AFB SITE - OFF-BASE EAST SOLDIER CREEK (AREA 4)
DERMAL EXPOSURE TO CHEMICALS IN SEDIMENTS DUE TO WADING AND SWIMMING
OFF-BASE CHILD AND ADULT RESIDENT - RME
(CURRENT AND FUTURE USE SCENARIO)

Equation : HIF = {[(SAc x EFc x EDc x ABS) / BWc + (SAa x EFa x EDa x ABS) / BWa] x CF} / (AT1 x AT2)
CDI = CS x AF x HIF
Hazard Quotient = CDI / RfD
Cancer Risk = CDI x Slope Factor

Where:
HIF= Human Intake Factor
CDI= Chronic Daily Intake
CS= Concentration in Sediments
SAc= Child Skin Surface Area Available for Contact = 6,500 cm^2
EFc= Child Exposure Frequency = 34 days per year
EDc= Child Exposure Duration = 5 years
BWc= Child Body Weight = 15.1 kg
SAa= Adult Skin Surface Area Available for Contact = 8,600 cm^2
EFa= Adult Exposure Frequency = 4 days per year
EDa= Adult Exposure Duration = 25 years
BWa= AdultBody Weight = 57.1 kg
AF= Adherence Factor = 1.0% for organics and 0.1% for inorganics
ABS= Absorption Factor = 1.0
AT1= Days Per Year = 365 days/year
AT2= Averaging Time (70 years for carcinogenic effects, 30 years for noncarcinogenic effects)
CF= Conversion Factor = 0.000001 kg/mg
SF= Slope Factor
RfD = Reference Dose

CHEMICALS OF CONCERN	CS (mg/kg)	NON-CANCER HIF (mg/kg-dy)	NON-CANCER CDI (mg/kg-dy)	RfD (mg/kg-dy)	HAZARD QUOTIENT (unitless)	CANCER HIF (mg/kg-dy)	CANCER CDI (mg/kg-dy)	SF $(mg/kg\text{-}dy)^{-1}$	CANCER RISK (unitless)
Metals									
Antimony	4 80E+00	8 06E-09	3 87E-08	4 00E-04	9 67E-05	3 45E-09	1 66E-08		
Beryllium	6 70E-01	8 06E-09	5 40E-09	5 00E-03	1 08E-06	3 45E-09	2 31E-09	4 30E+00	9 95E-09
Cadmium	2 50E+01	8 06E-09	2 02E-07	1 00E-03	2 02E-04	3 45E-09	8 64E-08		
Cobalt	8 10E+00	8 06E-09	6 53E-08	6 00E-02	1 09E-06	3 45E-09	2 80E-08		
Mercury	9 40E-02	8 06E-09	7 58E-10	3 00E-04	2 53E-06	3 45E-09	3 25E-10		
Thallium	1 30E+02	8 06E-09	1 05E-06	8 00E-05	1 31E-02	3 45E-09	4 49E-07		
Vanadium	2 70E+01	8 06E-09	2 18E-07	7 00E-03	3 11E-05	3 45E-09	9 33E-08		
Pesticides/PCBs									
Dieldrin	2 10E-03	8 06E-08	1 69E-10	5 00E-05	3 39E-06	3 45E-08	7 26E-11	1 60E+01	1 16E-09
Endosulfan II	2 10E-03	8 06E-08	1 69E-10	6 00E-03	2 82E-08	3 45E-08	7 26E-11		
Semivolatile Organics									
1,4-Dichlorobenzene	4 20E-02	8 06E-08	3 39E-09			3 45E-08	1 45E-09	2 40E-02	3 48E-11
1-Chloronaphthalene	4 90E-02	8 06E-09	3 95E-10	3 00E-02	1 32E-08	3 45E-09	1 69E-10		
2-Methylnaphthalene	1 30E-01	8 06E-08	1 05E-08	3 00E-02	3 49E-07	3 45E-08	4 49E-09		
Benzo(b)fluoranthene	4 00E-02	8 06E-08	3 22E-09			3 45E-08	1 38E-09	7 30E-01	1 01E-09
Chrysene	4 70E-02	8 06E-08	3 79E-09			3 45E-08	1 62E-09	7 30E-03	1 19E-11
Fluoranthene	5 90E-01	8 06E-08	4 76E-08	4 00E-02	1 19E-06	3 45E-08	2 04E-08		
Isophorone	4 70E-01	8 06E-08	3 79E-08	2 00E-01	1 89E-07	3 45E-08	1 62E-08	9 50E-04	1 54E-11
Phenanthrene	6 40E-02	8 06E-08	5 16E-09	3 00E-02	1 72E-07	3 45E-08	2 21E-09		
Pyrene	2 60E-01	8 06E-08	2 10E-08	3 00E-02	6 99E-07	3 45E-08	8 98E-09		
bis(2-Ethylhexyl)phthalate	5 20E+00	8 06E-08	4 19E-07	2 00E-02	2 10E-05	3 45E-08	1 80E-07	1 40E-02	2 52E-09
Volatile Organics									
2-Butanone (MEK)	7 00E-03	8 06E-08	5 64E-10	6 00E-01	9 41E-10	3 45E-08	2 42E-10		
Acetone	1 90E-02	8 06E-08	1 53E-09	1 00E-01	1 53E-08	3 45E-08	6 56E-10		
Carbon disulfide	4 00E-03	8 06E-08	3 22E-10	1 00E-01	3 22E-09	3 45E-08	1 38E-10		
Chlorobenzene	1 10E-01	8 06E-08	8 87E-09	2 00E-02	4 43E-07	3 45E-08	3 80E-09		
Methylene chloride	2 10E-03	8 06E-08	1 69E-10	6 00E-02	2 82E-09	3 45E-08	7 26E-11	7 50E-03	5 44E-13
				HAZARD INDEX =	1 35E-02			TOTAL CANCER RISK =	1 47E-08

APPENDIX B

SUPPORTING TABLES

APPENDIX B - SUPPORTING TABLES

TABLE B-1
FIRST EVENT THIRD YEAR LONG-TERM MONITORING
SEDIMENT SAMPLING DETECTIONS
0-6 inches (bgs), January 1997

	East Soldier Creek												West Soldier Creek						
	QE01	QE02	QE03	QE04	QE05	QE06	QE07	QE08	QE09	QE10	QE11	TR01	QW01	QW02	QW03	QW04	QW05	QW06	QW07
PCBs and Pesticides - Method 8080 (mg/kg)																			
Aldrin														0.037					
Aroclor 1254		10	1.7		0.15										2	4.4	6	1.9	
delta-BHC														0.014					
Endrin aldehyde																			
gamma-Chlordane																			
Heptachlor epoxide														0.72					
Semivolatile Organics - Method 8270 (mg/kg)																			
1,2-Dichlorobenzene																			
1,4-Dichlorobenzene									0.051										
1-Chloronaphthalene											0.046								
2-Chloronaphthalene									0.22										
2-Methylnaphthalene	0.075			0.05					0.064								0.28		
Acenaphthene	0.77		1.4	0.15			0.55	0.98									2		
Anthracene	1.5	0.26	1.6	0.14	0.054	1.2	2.3	3									3.2		
Benzidine																			
Benzo(a)anthracene	1.9	0.83	6.2	0.52	0.13	5.4	9.1	7.3	0.097			0.1	0.055	1.3	0.26	1.9	9.9	0.098	
Benzo(a)pyrene	1.5	0.87	7	0.47	0.15	6.8	11	7.3	0.13			0.11	0.073	1.7	0.35	5.2	7.9	0.096	
Benzo(b)fluoranthene	1.2	0.99	8.3	0.49	0.18	8.8	13	9.6	0.11			0.17	0.088	1.9	0.32	4.2	9.4	0.12	
Benzo(g,h,i)perylene	0.83	0.55	3.9	0.32	0.12	3.8	4.2	4.5	0.094			0.075	0.046	0.84	0.16	5.3	3.9	0.042	
Benzo(k)fluoranthene	1.4	0.76	5.1	0.47	0.15	7	8.6	5.9	0.13			0.17	0.096	2.4	0.57	4.1	8.3	0.16	
bis(2-Ethylhexyl)phthalate	0.29	2.6	1.6		0.047	6.4	1.7	7.5	3.3	5.2	0.8	0.26	0.083	1.3	1.2	3.4	1.4	0.16	
Butylbenzylphthalate																	0.47		
Chrysene	2	1.1	8.9	0.73	0.23	9.3	12	9.2	0.16		0.044	0.15	0.076	1.7	0.39	2.5	12	0.13	
Di-n-butylphthalate													0.2						
Di-n-octylphthalate																	0.66		
Dibenz(a,h)anthracene	0.31		1.3	0.12		1.5	1.9	1.6						0.22		1.6	0.36		
Dibenz(a,j)acridine							0.33												
Dibenzofuran	0.39		0.87	0.13	0.041		0.35	0.58									1.2		
Fluoranthene	5.4	2.7	25	1.9	0.69	21	32	25	0.67	0.83	0.29	0.31	0.14	2.6	0.68	3.4	27	0.29	0.074
Fluorene	0.72		1.1	0.14		0.55	1	1.4									2.2		
Indeno(1,2,3-cd)pyrene	0.85	0.5	4	0.3	0.11	3.8	4.6	4.3	0.067			0.069		0.81	0.17	4.7	4.3	0.041	
Naphthalene	0.19		1.4	0.26	0.089				0.046								0.69		
Phenanthrene	5.4	0.84	18	1.8	0.62	8.2	15	15	0.24			0.16	0.049	1.2	0.36	2.3	21	0.13	
Pyrene	4	2.1	17	1.6	0.59	12	17	15	0.25	0.26	0.085	0.24	0.13	2.4	0.57	2.8	25	0.26	0.079
Total Metals - Methods 6010/7060/7471/7740 (mg/kg)																			

TABLE B-1
FIRST EVENT THIRD YEAR LONG-TERM MONITORING
SEDIMENT SAMPLING DETECTIONS
0-6 inches (bgs), January 1997

	East Soldier Creek												West Soldier Creek						
	QE01	QE02	QE03	QE04	QE05	QE06	QE07	QE08	QE09	QE10	QE11	TR01	QW01	QW02	QW03	QW04	QW05	QW06	QW07
Aluminum	7430	750	2770	5600	7630	6030	1990	9210	6060	1790	4360	9580	14200	22700	6250	15800	2810	1800	13300
Antimony																			
Arsenic	2.1	3.1	15.7	2.9	5.5	5.6	1.6	6.4	2.7	0.89	2.3	3.1	2.3	4.7	1.5	2.8	1.6	1.8	2.1
Barium	1300	388	1200	830	683	721	358	645	726	177	3200	430	437	676	125	423	631	327	534
Beryllium	0.53			0.45	0.6			0.76	0.46			0.42	1.1	1.7	0.32	0.9			0.7
Cadmium		2.3	13.3			17.4	22.6	50.1	25.5	3.9	25.2	75.5	5.3	40.3	14.1	80	7.7	3.3	
Calcium	27000	93300	22200	13600	6450	36600	117000	37000	7310	141000	52900	7580	34200	45100	2950	15800	112000	74000	7390
Chromium	36.1	108	2800	99.7	19.5	276	210	318	236	31.6	220	543	32.6	744	224	1150	115	17.3	24.3
Cobalt	6.2	9.4	48.1	6.9	5	9.6	50.4	11.4	6.5	1.2	7	6	9.3	19.5	37.7	61.7	7.2	6.1	20.1
Copper	12.5	101	576	9.2	8.3	581	135	520	26.4	8	34.2	34.1	24.1	201	274	278	17.2	6.4	7.1
Iron	11500	13300	7370	10600	13600	10200	8250	14300	12300	3730	14400	15300	14700	24400	9580	15800	6230	5150	21400
Lead	13.3	349	528	20.5	12.2	190	174	124	37.3	38.1	42.3	94	50.6	202	65.9	298	253	7.1	20.7
Magnesium	2780	4410	3550	1980	1690	4430	3190	5040	2900	4990	27100	4740	8460	14800	2620	5870	5210	7630	2110
Manganese	353	356	143	338	481	214	110	228	1490	191	1780	356	585	677	124	478	233	751	1510
Mercury	0.1	0.24	3.7	0.25	0.047	0.54	0.26	0.4	0.17	0.077	0.098	0.45	0.039	0.38	0.38	0.32	0.055		0.016
Molybdenum		12.3	41.8			19.1	13.6	14.2			5.7			18.6	23	24.7	4.9		
Nickel	24.3	166	79	9.7	12.3	88.8	87.6	92.5	58.7	10.6	96.5	136	33.9	685	1430	1040	150	32.8	27.6
Potassium	870	133	350	607	849	869	264	1200	796	262	662	1390	2090	2730	822	1670	200	300	1260
Selenium			7.5											1.3	0.68	3.9			
Silver		2.9	2			8.1	14.2	6	3.1		5.8	9.3	2.2	24.8	99.2	82.3	15.7	4.5	
Sodium																			
Thallium	62.7		72.6	39.3						126	71.2		65.3	127					
Vanadium	15.9	18.6	82.9	19	18.9	43.5	21.3	43	25.2	5.3	19.1	22.4	25.2	82.1	33.2	77.8	10.1	11.1	35.5
Zinc	38.8	89.2	463	31	31.3	494	258	466	48.8	20.1	91.5	105	81.5	1180	482	1140	81.1	33.3	22.6
Volatile Organics - Method 8260 (mg/kg)																			
1,1,2,2-Tetrachloroethane		0.0027																	
2-Butanone (MEK)			0.0074			0.046	0.0029	0.047	0.0036	0.0029	0.0046	0.0034		0.014	0.011				
Acetone	0.01	0.0062	0.034	0.012	0.008	0.26	0.013	0.26	0.016	0.011	0.016	0.015		0.059	0.044	0.055	0.0019		
Acrylonitrile													0.015						
Carbon disulfide			0.0019								0.0038				0.0057				
Chlorobenzene						0.0059		0.14	0.0048										
Chloromethane			0.0038			0.025								0.004					
Ethylbenzene			0.0081			0.0075	0.0013								0.0045				
Methylene chloride		0.0015	0.0019										0.0016	0.005	0.0023		0.0018	0.002	
Styrene		0.0019	0.012				0.036								0.0032	0.5			
Toluene															0.034				

TABLE B-1
FIRST EVENT THIRD YEAR LONG-TERM MONITORING
SEDIMENT SAMPLING DETECTIONS
0-6 inches (bgs), January 1997

	East Soldier Creek												West Soldier Creek						
	QE01	QE02	QE03	QE04	QE05	QE06	QE07	QE08	QE09	QE10	QE11	TR01	QW01	QW02	QW03	QW04	QW05	QW06	QW07
Vinyl chloride															0.0028				
Xylenes (total)																			

TABLE B-2
FIRST EVENT THIRD YEAR LONG-TERM MONITORING
SEDIMENT SAMPLING DETECTIONS
6-12 inches (bgs), January 1997

	East Soldier Creek							West Soldier Creek				
	QE02	QE06	QE07	QE08	QE09	QE10	QE11	QW01	QW02	QW03	QW04	QW07
PCBs and Pesticides - Method 8080 (mg/kg)												
Aldrin												
Aroclor 1254	14									82	4.2	
delta-BHC		1.2										
Endrin aldehyde		0.042										
gamma-Chlordane		0.036										
Heptachlor epoxide		3.3										
Semivolatile Organics - Method 8270 (mg/kg)												
1,2-Dichlorobenzene											1.2	
1,4-Dichlorobenzene												
1-Chloronaphthalene					0.23		0.049					
2-Chloronaphthalene					0.053							
2-Methylnaphthalene		0.33									0.41	
Acenaphthene	0.43	0.35	0.72	0.044							0.86	
Anthracene	0.81	0.77	1.9	0.072							1.2	
Benzidine												
Benzo(a)anthracene	1.6	2.9	4.7	0.29						1.6	4.7	
Benzo(a)pyrene	1.6		5	0.31						1.8	4.6	
Benzo(b)fluoranthene	1.8	2.9	5.9	0.34	0.05		0.04			2.2	5.6	
Benzo(g,h,i)perylene	0.9	1.1	1.9	0.15	0.05					0.85	2.1	
Benzo(k)fluoranthene	1.1	2.8	4.8	0.28			0.039			2.3	5.5	
bis(2-Ethylhexyl)phthalate	4.4	19	1.3	3.2	0.55	1.1	4.9		0.25	8.7	1.6	
Butyl benzyl phthalate												
Chrysene	1.9	4	6.3	0.44	0.062		0.047			2.1	6.1	
Di-n-butyl phthalate												
Di-n-octyl phthalate										0.5		
Dibenz(a,h)anthracene	0.27	0.36	0.9	0.057							0.74	
Dibenz(a,j)acridine												

TABLE B-2
FIRST EVENT THIRD YEAR LONG-TERM MONITORING
SEDIMENT SAMPLING DETECTIONS
6-12 inches (bgs), January 1997

	East Soldier Creek							West Soldier Creek				
	QE02	**QE06**	**QE07**	**QE08**	**QE09**	**QE10**	**QE11**	**QW01**	**QW02**	**QW03**	**QW04**	**QW07**
Dibenzofuran	0.24		0.43								0.79	
Fluoranthene	5.5	10	18	1.3	0.35	0.53	0.3			3.6	13	
Fluorene	0.47	0.52	1.2	0.057							1	
Indeno(1,2,3-cd)pyrene	0.79	1.2	1.9	0.15						0.82	2.2	
Naphthalene											1.7	
Phenanthrene	2.3	4.7	9.6	0.5	0.067		0.064			2.2	11	
Pyrene	3.8	6.2	9.6	0.67	0.11	0.28	0.11			3.3	11	
Total Metals - Methods 6010/7060/7471/7740 (mg/kg)												
Aluminum	1320	7620	1670	1940	4710	3030	2880	12400	5020	11600	13800	10700
Antimony												
Arsenic	2.5	7.2	3.2	3.4	1.4	1.3	4.7	1.7	1.8	4.6	5.9	2.6
Barium	168	657	81.6	168	328	176	1790	197	179	325	401	416
Beryllium		0.63			0.35			0.8	0.29	0.81	0.71	0.48
Cadmium		14.8	7.4	12.2	7.4	7.8	10.2		2.3	112	111	
Calcium	121000	33300	119000	48600	2290	66800	96700	20300	5180	5230	5840	2000
Chromium	139	261	41.3	107	48.4	57.8	125	16.1	79.3	1110	721	18.1
Cobalt	21.1	10.2	2.8	6.7	4.3	2.2	8.1	8	5.3	166	42	5.6
Copper	109	436	52.5	40.4	9.6	19	23	18.6	11.7	2010	78	8
Iron	7850	11400	4600	3420	7760	4050	18500	12800	6660	13000	14300	13200
Lead	221	124	24.4	18.5	16.6	45.5	30.4	7.2	9.7	422	172	12.4
Magnesium	6120	5300	5790	1580	1360	5220	22000	10600	2270	3850	2560	1710
Manganese	310	242	210	108	216	192	1890	517	70.2	158	812	313
Mercury	0.34	0.35	0.1	0.042	0.036	0.036	0.1		0.081	0.55	0.24	
Molybdenum	28.2	27.3					7.2		3.4	262	16.4	
Nickel	319	73	20.9	32.9	13.8	12.8	64.7	18.8	57.8	6470	410	11.5
Potassium	193	1010	232	279	581	393	435	2050	735	1130	1420	1050
Selenium		0.88								10.3	1.3	
Silver		3.9	3.9	1.5			3.4		0.87	725	23.3	

TABLE B-2
FIRST EVENT THIRD YEAR LONG-TERM MONITORING
SEDIMENT SAMPLING DETECTIONS
6-12 inches (bgs), January 1997

	East Soldier Creek							West Soldier Creek				
	QE02	**QE06**	**QE07**	**QE08**	**QE09**	**QE10**	**QE11**	**QW01**	**QW02**	**QW03**	**QW04**	**QW07**
Sodium												
Thallium	126					54.6	39.3	53.9		74.2		
Vanadium	10.1	46	8.9	9.8	13.6	7.6	15.3	16.2	117	114	45.2	25.7
Zinc	65.6	362	52.4	45.1	29.8	47.2	45.5	50.3	44.8	2310	427	21
Volatile Organics - Method 8260 (mg/kg)												
1,1,2,2-Tetrachloroethane												
2-Butanone (MEK)	0.0034	0.037	0.0028		0.0048	0.0052	0.0043		0.0073	0.028		
Acetone	0.017	0.19	0.011	0.062	0.019	0.021	0.019		0.027	0.089		0.025
Acrylonitrile												
Carbon disulfide	0.0018	0.0087				0.0013	0.0045					
Chlorobenzene	0.0074	0.011		0.91	0.021							
Chloromethane												
Ethylbenzene	0.0025									0.053	0.013	
Methylene chloride	0.0016							0.0017	0.0018	0.017		
Styrene	0.0031		0.0045							0.031	0.33	
Toluene									0.018	0.021		
Vinyl chloride	0.0013											
Xylenes (total)	0.0018	0.0061										

TABLE B-3
FIRST EVENT THIRD YEAR LONG-TERM MONITORING
SEDIMENT SAMPLING DETECTIONS
Greater than 12 inches (bgs), January 1997

	East Soldier Creek				West Soldier Creek			
	QE06 1.0-1.5 feet	QE07 3.0-3.5 feet	QE09 1.0-2.0 feet	QE10 2.0-3.0 feet	QW01 1.0-1.5 feet	QW03 1.0-2.0 feet	QW04 2.0-2.5 feet	QW07 3.0-3.5 feet
PCBs and Pesticides - Method 8080 (mg/kg)								
Aldrin								
Aroclor 1254						15	10	
delta-BHC								
Endrin aldehyde								
gamma-Chlordane								
Heptachlor epoxide								
Semivolatile Organics - Method 8270 (mg/kg)								
1,2-Dichlorobenzene							1.6	
1,4-Dichlorobenzene								
1-Chloronaphthalene		0.1						
2-Chloronaphthalene			0.1					
2-Methylnaphthalene							0.85	
Acenaphthene			0.066				1.1	
Anthracene	0.32		0.079				1.6	
Benzidine						0.22		
Benzo(a)anthracene	1.3	0.063	0.36			0.33	5.7	
Benzo(a)pyrene	1.6	0.054	0.39			0.36	5.8	
Benzo(b)fluoranthene	1.6	0.044	0.45			0.53	5.5	
Benzo(g,h,i)perylene	0.67	0.046	0.28			0.16	2.2	
Benzo(k)fluoranthene	1.5	0.055	0.35			0.5	9.5	
bis(2-Ethylhexyl)phthalate	1.8	0.45	0.27	0.31		1.2	19	
Butyl benzyl phthalate								
Chrysene	1.8	0.088	0.52			0.46	7	
Di-n-butyl phthalate	0.3		0.044					
Di-n-octyl phthalate								
Dibenz(a,h)anthracene			0.095				0.76	

TABLE B-3
FIRST EVENT THIRD YEAR LONG-TERM MONITORING
SEDIMENT SAMPLING DETECTIONS
Greater than 12 inches (bgs), January 1997

	East Soldier Creek				West Soldier Creek			
	QE06 1.0-1.5 feet	QE07 3.0-3.5 feet	QE09 1.0-2.0 feet	QE10 2.0-3.0 feet	QW01 1.0-1.5 feet	QW03 1.0-2.0 feet	QW04 2.0-2.5 feet	QW07 3.0-3.5 feet
Dibenz(a,j)acridine								
Dibenzofuran							1.1	
Fluoranthene	4.4	0.3	1.3	0.14		0.84	21	
Fluorene			0.053				1.4	
Indeno(1,2,3-cd)pyrene	0.65		0.27			0.17	2.2	
Naphthalene		0.11	0.28				2.1	
Phenanthrene	2.8	0.15	0.77			0.44	14	
Pyrene	3	0.22	0.9			0.78	12	
Total Metals - Methods 6010/7060/7471/7740 (mg/kg)								
Aluminum	7910	4400	2900	6830	17400	3010	7320	8000
Antimony							11.4	
Arsenic	3.6	2.1	2.3	1.4	0.62	1.3	9.7	3.9
Barium	498	174	276	184	67.4	96.3	771	457
Beryllium	0.65	0.28	0.29		1.5		0.34	0.82
Cadmium	19.3	3.9	51.8	2.4		5.6	212	
Calcium	15100	2290	4400	26200	27000	6000	14600	1920
Chromium	549	18	142	31.3	19.5	67.5	4020	23.9
Cobalt	16.7	2.8	4.4	3.9	13.3	12	161	9
Copper	107	10.7	19.8	7.6	37.3	52.9	166	13.7
Iron	10500	7540	6160	9650	18300	5630	15400	20900
Lead	318	6.6	55	13	8.1	24	934	4.9
Magnesium	3710	1260	2160	2690	23400	2150	2900	2890
Manganese	382	163	224	185	1080	161	7430	258
Mercury	0.31	0.08	0.1	0.045		0.11	0.22	
Molybdenum	4.9					19.1	40.9	
Nickel	75.5	12.3	22.6	18.7	32.9	380	1190	24.3
Potassium	999	491	404	964	3520	487	864	806

TABLE B-3
FIRST EVENT THIRD YEAR LONG-TERM MONITORING
SEDIMENT SAMPLING DETECTIONS
Greater than 12 inches (bgs), January 1997

	East Soldier Creek				West Soldier Creek			
	QE06 1.0-1.5 feet	QE07 3.0-3.5 feet	QE09 1.0-2.0 feet	QE10 2.0-3.0 feet	QW01 1.0-1.5 feet	QW03 1.0-2.0 feet	QW04 2.0-2.5 feet	QW07 3.0-3.5 feet
Selenium						0.92	2.8	
Silver	2.9		2			21.8	105	
Sodium					495			
Thallium				46.3	64.9	45.1	62.4	
Vanadium	22.7	13.4	13.7	17.8	17.3	15.5	56.9	39.9
Zinc	237	12.1	76.8	18.1	39.4	106	590	26.4
Volatile Organics - Method 8260 (mg/kg)								
1,1,2,2-Tetrachloroethane								
2-Butanone (MEK)	0.013	0.0026	0.0081			0.0062	0.0034	
Acetone	0.067	0.014	0.031	0.0058	0.005	0.023	0.016	0.0034
Acrylonitrile								
Carbon disulfide								
Chlorobenzene	0.0083		0.054					
Chloromethane								
Ethylbenzene						0.0019		
Methylene chloride						0.0019	0.0022	
Styrene						0.0024	0.0047	
Toluene						0.0024		
Vinyl chloride								
Xylenes (total)	0.0015							

TABLE B-4
SECOND EVENT THIRD YEAR MONITORING SEDIMENT DETECTIONS
0-6 inches bgs, July 1997

	East Soldier Creek												West Soldier Creek						
	QE01	QE02	QE03	QE04	QE05	QE06	QE07	QE08	QE09	QE10	QE11	TR01	QW01	QW02	QW03	QW04	QW05	QW06	QW07
PCBs and Pesticides - Method 8080 (mg/kg)																			
4,4'-DDD						0.09			0.042										
4,4'-DDE															0.0085				
Aldrin								0.13							0.0044				
alpha-Chlordane	0.014																		
Aroclor 1254		1.7	3.6	0.054	0.25									0.088	0.12	0.063	0.23	1	
Aroclor 1260	0.68																		
Dieldrin											0.0038				0.002				
Endosulfan II						0.093			0.05		0.0024								
gamma-Chlordane	0.025																		
Heptachlor																			
Heptachlor epoxide															0.0061				
Semivolatile Organics - Method 8270 (mg/kg)																			
1,2-Dichlorobenzene			0.22																
1,3-Dichlorobenzene																			
1,4-Dichlorobenzene									0.13										
1-Chloronaphthalene							0.16												
2,4-Dimethylphenol									0.064										
2-Chloronaphthalene						0.36			0.5										
2-Methylnaphthalene			0.47			0.2	0.048	0.18											
3-Methylcholanthrene								0.25											
Acenaphthene			2.2		0.14	0.26	0.079	0.78	0.24										
Acenaphthylene															0.043				
Acetophenone						0.11													
Anthracene			4.4		0.33	0.44	0.14	2.7	0.26						0.061				
Benzo(a)anthracene	0.43	1.6	7.1		1.2	1.5	0.54	6.9	1						0.33	0.11		0.1	0.046
Benzo(a)pyrene	0.54	1.6	5.9		0.94	1.4	0.54	9.3	1.3					0.055	0.45	0.12		0.091	0.05
Benzo(b)fluoranthene	0.46	1.7	6.6		1	2.1	0.61	11	1.4					0.052	0.62	0.11		0.072	0.066
Benzo(g,h,i)perylene	0.92	1.7	2		0.24	0.76	0.33	4.3	0.6					0.055	0.35	0.15		0.052	
Benzo(k)fluoranthene	0.53	1.4	4.9		1.3	2	0.49	12	1.4					0.053	0.39	0.12		0.1	0.053
Benzoic acid	0.28																		
bis(2-Ethylhexyl)phthalate	2.8	0.83	0.86		1.6	13	0.47	6.8	0.42		0.1				0.14	0.061		0.13	0.048
Butyl benzyl phthalate								0.51											
Chrysene	0.68	2.2	7.9		1.3	2.2	0.76	12	1.7					0.068	0.47	0.15		0.12	0.074
Di-n-butyl phthalate									0.068										
Dibenz(a,h)anthracene	0.22				0.11		0.15	1.5	0.17						0.088				
Dibenzofuran			1.5		0.067		0.051	0.56	0.18										
Fluoranthene	1.2	6.4	17	0.053	2.9	4.5	1.7	24	3.8		0.086			0.093	0.62	0.25	0.057	0.27	0.13

TABLE B-4
SECOND EVENT THIRD YEAR MONITORING SEDIMENT DETECTIONS
0-6 inches bgs, July 1997

	East Soldier Creek												West Soldier Creek						
	QE01	QE02	QE03	QE04	QE05	QE06	QE07	QE08	QE09	QE10	QE11	TR01	QW01	QW02	QW03	QW04	QW05	QW06	QW07
Fluorene			2.5		0.11	0.24	0.089	1.2	0.26										
Indeno(1,2,3-cd)pyrene	0.74	1.4	2.3		0.28	0.83	0.34	4.5	0.59					0.047	0.31	0.13		0.047	
Isophorone																			
Naphthalene			2.1			0.14	1.4	0.19	1.3										
Phenanthrene	0.44	3.7	16		1.7	2.4	1.3	13	2.6					0.041	0.23	0.13		0.12	0.047
Pyrene	0.74	3.6	13	0.058	2.2	3.5	1.1	16	2.4					0.084	0.45	0.2	0.054	0.16	0.1
Total Metals - Methods 6010/7060/7471/7740 (mg/kg)																			
Aluminum	8310	2440	3640	6580	3130	8210	6160	7770	3680	6160	3970	4830	8360	4950	9980	12000	2570	2050	3580
Antimony				4.6			3.9	7.6			4.8							4.4	
Arsenic	2.7	5.3	2.6	1.8	1.5	4	1.5	4.3	2.8	1.2	1.9	1.6	1.7	1.1	2.5	3.6	1.4	1.8	2.3
Barium	2370	913	559	583	397	746	291	751	396	254	544	368	308	227	490	549	285	175	216
Beryllium	0.76		0.55	0.65	0.32	0.68	0.71	0.82	0.6	0.67	0.6	0.56	0.97	0.59	0.82	0.96	0.51	0.27	0.45
Cadmium	10.2	11			5.2	31.6	55.1	38.2	837		16.9	0.63	1.7	0.72	3.4	10.1	1.2	16.6	
Calcium	21900	14000	31100	8030	15800	27800	2140	36300	42700	1660	55000	1370	12200	27600	50900	6670	11200	79300	3690
Chromium	1700	804	385	18.6	89.7	282	226	306	988	12.9	199	17.3	25.6	15.7	49.3	150	22.2	104	11.3
Cobalt	13.7	36.6	11.7	7.6	9.3	12.1	5.2	12	14.3	3	7.9	4.8	8	5.4	12.6	11.5	7.3	6.4	3.6
Copper	421	188	85.1	11.6	89.7	459	18.2	548	100	9.9	23	7.1	20.5	10.9	31.6	25.4	6.3	8.5	5.8
Iron	14000	6780	14400	12200	6590	12500	8800	13300	6920	8620	12400	11100	12100	9600	14900	15300	12500	6350	7360
Lead	301	415	27.8	10.1	93.2	160	38	173	409	6.8	47.9	8.1	33.8	17.1	54.4	78.9	20.5	20.5	11.3
Magnesium	6920	2560	3570	1910	1980	4280	1700	4510	2120	1250	23900	920	5660	7400	4230	3330	3050	7800	847
Manganese	235	109	1830	262	220	250	222	244	205	215	1660	177	733	494	424	508	934	791	299
Mercury	3.4	8.3	0.36		0.11	0.4	0.11	0.45	0.32		0.023				0.024	0.042		0.013	
Molybdenum	4.4	14.5	5.7	11.8	5.7	8.9	1.3	10.6	7.9	2	1.9				3.9	5.5	1.1	1.4	
Nickel	68.6	50.8	64.2	16.2	40.8	109	176	114	62.7	10.3	65.7	9.3	35.2	17.2	107	180	18.7	57.8	6.7
Potassium	806	363	588	696	455	1270	982	1270	551	845	537	760	1270	805	1420	1430	696	190	430
Selenium	1.1	2.1				0.81			0.78										
Silver	8.2	0.8	1.6	0.44	2.6	7.3	4.4	6.8	15.2		2.7	0.47	0.91	0.47	9.1	9.7	0.56	8.3	0.52
Sodium							118				159	153		133			242		213
Thallium			25.3	18.7						17	37.8		18.3	13.6					
Vanadium	37.8	27.7	23.2	20.3	14.9	36.4	13.3	45.8	15.4	21.8	26.6	20.9	30.7	23.3	30.2	32.7	23.4	15.4	16.6
Zinc	515	671	529	21.5	103	341	69	486	336	12.1	39.7	15	48.2	32.7	173	99.4	23.6	78	18.9
Volatile Organics - Method 8260 (mg/kg)																			
1,1-Dichloroethane			0.0016																
2-Butanone (MEK)		0.01			0.0025	0.026	0.0051	0.048			0.0036								
Acetone	0.015	0.037	0.023	0.0095	0.013	0.1	0.023	0.23	0.0092	0.015	0.014				0.0057			0.0056	
Benzene								0.021											
Carbon disulfide		0.0092	0.0015																
Chlorobenzene			0.029			0.0092	0.023	2.1	0.01		0.019								

TABLE B-4
SECOND EVENT THIRD YEAR MONITORING SEDIMENT DETECTIONS
0-6 inches bgs, July 1997

	East Soldier Creek												West Soldier Creek						
	QE01	QE02	QE03	QE04	QE05	QE06	QE07	QE08	QE09	QE10	QE11	TR01	QW01	QW02	QW03	QW04	QW05	QW06	QW07
Methylene chloride					0.0021	0.0051	0.0019	0.021		0.0021					0.0014				
Toluene																			
Trichloroethene			0.0019																
Xylenes (total)																			

TABLE B-5
SECOND EVENT THIRD YEAR MONITORING SEDIMENT DETECTIONS
6-12 inches bgs, July 1997

	East Soldier Creek						West Soldier Creek				
	QE06	QE07	QE08	QE09	QE10	QE11	QW01	QW02	QW03	QW04	QW07
PCBs and Pesticides - Method 8080 (mg/kg)											
4,4'-DDD	0.076										
4,4'-DDE											
Aldrin											
alpha-Chlordane											
Aroclor 1254									0.24		
Aroclor 1260											
Dieldrin											
Endosulfan II	0.079										
gamma-Chlordane											
Heptachlor											
Heptachlor epoxide											
Semivolatile Organics - Method 8270 (mg/kg)											
1,2-Dichlorobenzene		0.13									
1,3-Dichlorobenzene			0.38								
1,4-Dichlorobenzene			1.1			0.042					
1-Chloronaphthalene				0.06							
2,4-Dimethylphenol											
2-Chloronaphthalene	0.29	0.065		0.061							
2-Methylnaphthalene		0.37	4.5			0.13					
3-Methylcholanthrene											
Acenaphthene		0.28	0.21				0.044				
Acenaphthylene											
Acetophenone											
Anthracene	0.43	0.44					0.078				
Benzo(a)anthracene	1.3	1.7	0.33	0.1			0.33		0.086	0.097	
Benzo(a)pyrene	1.5	1.9	0.31	0.12			0.27		0.095	0.12	
Benzo(b)fluoranthene	2.3	1.5	0.37	0.15			0.23		0.12	0.12	
Benzo(g,h,i)perylene	0.91	0.96	0.43	0.081			0.21		0.13	0.17	

TABLE B-5
SECOND EVENT THIRD YEAR MONITORING SEDIMENT DETECTIONS
6-12 inches bgs, July 1997

	East Soldier Creek						West Soldier Creek				
	QE06	QE07	QE08	QE09	QE10	QE11	QW01	QW02	QW03	QW04	QW07
Benzo(k)fluoranthene	1.8	2	0.3	0.13			0.31		0.1	0.14	
Benzoic acid											
bis(2-Ethylhexyl)phthalate	6.6	3.5	14	1.8			0.048		0.089	0.069	
Butyl benzyl phthalate											
Chrysene	2.3	2.1	0.63	0.18			0.39		0.13	0.17	
Di-n-butyl phthalate		0.05									
Dibenz(a,h)anthracene	0.33	0.36								0.057	
Dibenzofuran		0.18									
Fluoranthene	4.7	4.8	6.5	1			0.69		0.21	0.27	
Fluorene		0.26	0.28								
Indeno(1,2,3-cd)pyrene	0.81	1	0.31	0.076			0.19		0.11	0.14	
Isophorone						0.47					
Naphthalene		4	1.6	0.047							
Phenanthrene	2.4	3.5	1.2	0.12			0.45		0.12	0.21	
Pyrene	2.9	2.9	1.1	0.25			0.59		0.19	0.27	
Total Metals - Methods 6010/7060/7471/7740 (mg/kg)											
Aluminum	8940	4530	5420	1740	5670	4270	6880	2280	6940	8160	7350
Antimony	6.2		6.1								
Arsenic	4.8	1.8	4	1.5	0.83	1.7	1.5	0.81	2.4	2.7	0.99
Barium	655	414	499	218	296	560	240	63.2	542	521	364
Beryllium	0.72	0.59	0.61	0.27	0.63	0.61	0.8	0.36	0.78	0.85	0.93
Cadmium	27.9	255	88.2	33.4			0.57		3.6	11.5	
Calcium	21000	5370	14800	67800	1490	1780	14800	4360	16000	6450	16600
Chromium	273	686	1210	180	13	14.5	15.1	10.6	59.5	375	28.5
Cobalt	10.7	7.5	12	4.2	4.8	4.3	6.6	2.4	10.5	16.4	7.7
Copper	401	48.1	116	32.4	9.5	9.3	15.9	2.5	22.6	22.4	9
Iron	12700	8210	9320	4830	8310	7720	10300	6000	10400	11900	20300
Lead	136	160	85.5	34.9	10.4	10.6	20	7.4	51.4	84.7	10.3
Magnesium	3990	1990	2510	3370	1200	1270	7320	2980	2640	2950	3500

TABLE B-5
SECOND EVENT THIRD YEAR MONITORING SEDIMENT DETECTIONS
6-12 inches bgs, July 1997

	East Soldier Creek						West Soldier Creek				
	QE06	QE07	QE08	QE09	QE10	QE11	QW01	QW02	QW03	QW04	QW07
Manganese	251	475	530	323	250	123	605	145	449	725	339
Mercury	0.41	0.3	0.29	0.18					0.028	0.12	
Molybdenum	7.3	1.7	5.1	1.3	1.2				7.7	4.2	1
Nickel	92.4	480	300	51.5	9.1	9.1	18.1	6.8	77.6	90.5	21.2
Potassium	1400	800	821	271	823	636	1130	568	867	994	805
Selenium	1.9		0.52	0.51							
Silver	4.7	13.1	14.8	3.5					4.5	5.2	
Sodium			177		127		107	131	126		517
Thallium			20.4				31.6				36.5
Vanadium	34	17	20.4	10.7	19.4	20.7	19.6	23.4	27.5	28.8	36
Zinc	268	210	128	57	12.2	11.1	59.3	7.9	82.4	73.6	24.6
Volatile Organics - Method 8260 (mg/kg)											
1,1-Dichloroethane											
2-Butanone (MEK)	0.018	0.012		0.0032		0.0083					
Acetone	0.097	0.046		0.017	0.0098	0.033					
Benzene											
Carbon disulfide											
Chlorobenzene	0.0051	0.072	18	0.0014		0.15					
Methylene chloride	0.0055	0.0022			0.0017				0.0018	0.0014	
Toluene	0.013	0.0015									
Trichloroethene											
Xylenes (total)		0.0031									

TABLE B-6
SECOND EVENT THIRD YEAR MONITORING SEDIMENT DETECTIONS
Greater than 12 inches bgs, July 1997

	East Soldier Creek	West Soldier Creek			
	QE07 1.5-2.0 feet	QW01 1.0-1.5 feet	QW03 1.5-2.0 feet	QW04 2.5-3.0 feet	QW07 1.0-1.5 feet
PCBs and Pesticides - Method 8080 (mg/kg)					
4,4'-DDD					
4,4'-DDE					
Aldrin					
alpha-Chlordane					
Aroclor 1254					
Aroclor 1260					
Dieldrin					
Endosulfan II					
gamma-Chlordane					
Heptachlor	0.011				
Heptachlor epoxide					
Semivolatile Organics - Method 8270 (mg/kg)					
1,2-Dichlorobenzene					
1,3-Dichlorobenzene					
1,4-Dichlorobenzene					
1-Chloronaphthalene					
2,4-Dimethylphenol					
2-Chloronaphthalene					
2-Methylnaphthalene					
3-Methylcholanthrene					
Acenaphthene					
Acenaphthylene					
Acetophenone					
Anthracene		0.043			
Benzo(a)anthracene		0.16		0.064	
Benzo(a)pyrene		0.17		0.084	
Benzo(b)fluoranthene		0.13		0.089	
Benzo(g,h,i)perylene		0.1		0.12	
Benzo(k)fluoranthene		0.19		0.078	
Benzoic acid					
bis(2-Ethylhexyl)phthalate					
Butyl benzyl phthalate					
Chrysene		0.2		0.093	
Di-n-butyl phthalate					
Dibenz(a,h)anthracene					
Dibenzofuran					
Fluoranthene		0.32		0.15	
Fluorene					
Indeno(1,2,3-cd)pyrene		0.1		0.093	
Isophorone					
Naphthalene					

TABLE B-6
SECOND EVENT THIRD YEAR MONITORING SEDIMENT DETECTIONS
Greater than 12 inches bgs, July 1997

	East Soldier Creek	West Soldier Creek			
	QE07 1.5-2.0 feet	QW01 1.0-1.5 feet	QW03 1.5-2.0 feet	QW04 2.5-3.0 feet	QW07 1.0-1.5 feet
Phenanthrene		0.18		0.075	
Pyrene		0.25		0.12	
Total Metals - Methods 6010/7060/7471/7740 (mg/kg)					
Aluminum	2620	6870	2900	6730	6210
Antimony					4.8
Arsenic	2.4	1.2	1.5	0.88	2
Barium	713	199	193	315	87.5
Beryllium	0.36	0.81	0.35	0.46	1
Cadmium	143			0.82	
Calcium	839	12400	4930	2240	1230
Chromium	340	16.1	15.6	16.1	36
Cobalt	6.8	6.2	3.4	4.3	8.2
Copper	91.8	14.5	5.1	4.8	7.4
Iron	6380	10900	6870	4840	22500
Lead	6.4	15.3	8.2	5.4	12.2
Magnesium	764	6490	2710	1140	3310
Manganese	1450	562	458	121	302
Mercury	0.048				
Molybdenum	3.7		2.8		
Nickel	1360	16.3	15.2	6.6	23.9
Potassium	541	1090	454	654	701
Selenium					
Silver	2.9		0.95	0.43	0.5
Sodium	119			118	1090
Thallium		17.5			37
Vanadium	17	22.1	17.2	7.1	40.9
Zinc	30.3	43.3	15	11.1	28
Volatile Organics - Method 8260 (mg/kg)					
1,1-Dichloroethane					
2-Butanone (MEK)					
Acetone	0.0066				
Benzene					
Carbon disulfide					
Chlorobenzene					
Methylene chloride	0.0015			0.0015	
Toluene					
Trichloroethene					
Xylenes (total)					

TABLE B-7
FIRST EVENT THIRD YEAR LONG-TERM MONITORING
SURFACE WATER DETECTIONS
January 1997

	East Soldier Creek											West Soldier Creek			
	QE01	QE02	QE03	QE04	QE05	QE06	QE07	QE08	QE09	QE10	QE11	QW03	QW05	QW06	QW07
Dissolved Metals - Methods 6010/6020 (mg/L)															
Aluminum						0.068	0.006	0.11	0.12	0.15				0.0066	0.11
Antimony								0.00018	0.0002	0.00022	0.00023	0.00051	0.00022	0.00024	
Barium	0.41	0.47	0.48	0.4	0.4	0.42	0.42	0.41	0.41	0.4	0.37	0.12	0.26	0.24	0.052
Cadmium	0.00012	0.00024	0.00021	0.00018	0.00023	0.00049	0.0026	0.00079	0.001	0.0021	0.0014	0.00067	0.00068	0.00084	
Calcium	43.7	67.2	70.4	48.7	45.8	50.1	43.1	44.9	47.8	43.6	43.3	24.5	41.8	39.7	16.7
Chromium	0.0089	0.013	0.013	0.0085	0.0087	0.0096	0.01	0.01	0.0098	0.011	0.0078	0.0036	0.0071	0.0072	0.0013
Cobalt	0.000093	0.00015	0.00016	0.000099	0.000085	0.00014	0.000072	0.00015	0.00016	0.00018	0.00016	0.0014	0.00011	0.00011	
Copper	0.0013	0.047	0.04	0.015	0.0063	0.014	0.0098	0.014	0.014	0.014	0.0069	0.003	0.0053	0.0055	0.0039
Iron		0.042	0.054			0.024					0.073	0.1	0.025	0.031	
Lead		0.00027	0.00039			0.0013	0.001	0.0012	0.0013	0.0018	0.00043	0.0002			
Magnesium	22.3	33.3	34.7	24	22.9	24.9	22.2	22.1	23.4	21.3	21	3.3	17.7	16.3	1.1
Manganese	0.0037	0.011	0.013	0.00099	0.0063	0.021	0.00047	0.016	0.017	0.016	0.065	0.061	0.0019	0.0033	0.0095
Molybdenum	0.00028	0.0029	0.0032	0.0018	0.00086	0.0014	0.00019	0.0018	0.0018	0.0019	0.0021	0.019	0.0056	0.0062	0.00046
Nickel	0.00054	0.0014	0.00016	0.00093	0.00074	0.0012	0.00097	0.0015	0.0015	0.0019	0.0019	0.038	0.004	0.0048	0.00069
Potassium	1.4	2	2.1	1.4	1.4	1.5	1.2	1.5	1.6	1.5	1.6	1.6	1.5	1.6	1.6
Silver		0.000035													
Sodium	14.4	26	28.2	16.4	15.3	17.8	12.9	17.3	18.8	17	17.3	4.1	20.7	19.2	5.2
Thallium	0.000044		0.000054												
Vanadium	0.013	0.019	0.019	0.013	0.013	0.013	0.013	0.014	0.013	0.014	0.012	0.00099	0.0079	0.007	0.0013
Zinc	0.0036	0.0084	0.0087	0.0059	0.0054	0.011	0.024	0.0091	0.0094	0.011	0.0054	0.019	0.0081	0.012	0.036
PCBs and Pesticides - Method 8080 (ug/L)															
Aroclor 1254		0.58													
Semivolatile Organics - Method 8270 (mg/L)															
bis(2-Ethylhexyl)phthalate											0.0041	0.013		0.0016	0.01
Total Metals - Methods 6010/6020/7060/7470 (mg/L)															
Aluminum		0.0059			0.048	0.031		0.034	0.0057	0.06		0.013	0.0095	0.012	0.04
Antimony	0.00004		0.00012		0.00023	0.00012	0.0002	0.00025		0.00022	0.00029	0.00055	0.00028	0.00044	0.00013
Arsenic		0.0026	0.0027							0.0023	0.0024				
Barium	0.41	0.55	0.52	0.41	0.44	0.45	0.43	0.42	0.43	0.41	0.36	0.12	0.28	0.27	0.05
Cadmium		0.00015	0.00014	0.000086	0.0005	0.00022	0.0012	0.00038	0.000086	0.00094	0.0006	0.00088	0.00047	0.00052	
Calcium	42.7	72.4	68.9	47.7	45.3	48.2	42.3	46.7	46.2	44.5	44.5	23.8	40.4	38.2	17.7
Chromium	0.0047	0.014	0.011	0.0059	0.0059	0.0057	0.0066	0.0054	0.0048	0.0063	0.0041	0.0016	0.003	0.0028	0.0004
Cobalt	0.00026	0.00058	0.00053	0.00035	0.00044	0.00039	0.00027	0.00038	0.0003	0.0004	0.00036	0.0018	0.00034	0.00036	0.00017
Copper	0.0013	0.083	0.063	0.023	0.015	0.014	0.01	0.014	0.0095	0.014	0.0066	0.0061	0.0062	0.0063	0.0041
Iron	0.033	0.14	0.13	0.089	0.061	0.11	0.024	0.13	0.16	0.15	0.34	0.44	0.046	0.053	0.06
Lead		0.0012	0.00086	0.0005	0.0012	0.0013	0.00094	0.0011	0.00047	0.0016	0.00023		0.00017	0.00022	
Magnesium	21.8	36.1	34	23.5	22.7	23.6	21.4	22.6	22.5	21.4	21.7	3.2	16.5	14.9	1.2
Manganese	0.0036	0.011	0.013	0.0099	0.017	0.021	0.00021	0.014	0.0069	0.015	0.06	0.067	0.0028	0.0039	0.008
Molybdenum	0.00045	0.0027	0.0031	0.0019	0.0021	0.0014	0.00034	0.0021	0.0011	0.0022	0.0022	0.02	0.0063	0.0083	0.0006
Nickel	0.0096	0.02	0.016	0.011	0.012	0.012	0.01	0.011	0.01	0.012	0.011	0.052	0.014	0.016	0.0075
Potassium	1.4	2.3	2.2	1.5	1.5	1.6	1.4	1.7	1.6	1.6	1.6	1.5	1.4	1.5	1.6
Selenium		0.0042	0.0039		0.0027					0.0023	0.0023				
Silver					0.00013										
Sodium	14.9	29.3	27.7	16.5	16.1	17.2	12.3	15.9	17.2	17.7	17.9	4	20.7	19.3	5.4
Vanadium	0.0095	0.018	0.016	0.01	0.011	0.01	0.011	0.01	0.0098	0.011	0.0088	0.001	0.0059	0.0055	0.0008

TABLE B-7
FIRST EVENT THIRD YEAR LONG-TERM MONITORING
SURFACE WATER DETECTIONS
January 1997

	East Soldier Creek											West Soldier Creek			
	QE01	QE02	QE03	QE04	QE05	QE06	QE07	QE08	QE09	QE10	QE11	QW03	QW05	QW06	QW07
Zinc	0.0047	0.016	0.013	0.0076	0.0081	0.01	0.025	0.0073	0.0064	0.0093	0.0034	0.031	0.012	0.016	0.036
Volatile Organics - Method 8260 (mg/L)															
2-Butanone (MEK)	0.0024	0.0033		0.0015			0.0062	0.0018	0.0016		0.0018				0.0014
Acetone	0.0031	0.0049	0.003	0.0033	0.0067	0.0036	0.0061	0.0037	0.0045	0.0048	0.0072	0.0058	0.0035	0.0034	0.007
Acrolein		0.0019							0.0025						
Acrylonitrile		0.0022							0.0027						
Bromoform			0.0016												
Bromomethane												0.0015	0.0072	0.0042	
Chloroform															
Chloromethane												0.0011	0.0036	0.0021	
Dibromochloromethane			0.0018												
Ethanol		0.041													
Iodomethane													0.0018	0.0012	
Methylene chloride		0.0047	0.0059			0.0039	0.0033								
Styrene												0.0034			
Wet Chemistry - Methods 130.2/160.1/160.2/300.0/310.1/410.4/415.1 (mg/L)															
Alkalinity, Bicarb as CaCO3 at	199	126	137	184	191	184	196	174	174	168	175	88	191	182	41.9
Alkalinity, Carb as CaCO3 at pH	8.3						6.6		5.6	6.2					
Alkalinity, Total as CaCO3 at p	199	126	137	184	191	184	203	179	180	174	176	88	191	182	41.9
Chemical Oxygen Demand (Regular)		13.8	10.9									25.6	14.3	24.3	9.6
Chloride	8.3	16.8	16.1	9.6	9	10.2	8.2	10.2	10.2	9.9	10.4	4	9.2	9	6.9
Hardness as CaCO3	184	312	296	202	194	213	186	207	200	198	202	76	169	156	54.7
Sulfate	5.3	232	198	50.1	24.7	55.4	4.9	53.7	52.3	49.1	48.3	2.1	10.7	10	7.6
Total Dissolved Solids	235	507	481	286	257	301	236	290	286	274	281	90	242	220	93
Total Organic Carbon	0.71	9.5	8.1	2.5	1.2	3.1	0.86	4.4	4.3	4	4.1	10.5	5.5	7.7	4.3
Total Suspended Solids										4	3.6	1.6			2.4

TABLE B-8
SECOND EVENT THIRD YEAR MONITORING
SURFACE WATER DETECTIONS
July 1997

	East Soldier Creek											West Soldier Creek		
	QE01	**QE02**	**QE03**	**QE04**	**QE05**	**QE06**	**QE07**	**QE08**	**QE09**	**QE10**	**QE11**	**QW05**	**QW06**	**QW07**
Dissolved Metals - Methods 6010/6020 (mg/L)														
Aluminum		0.0031	0.0036	0.0035			0.0035			0.0036	0.0056		0.0033	0.0075
Antimony						0.00017	0.00035			0.00017	0.00026			0.0003
Barium	0.44	0.39	0.39	0.44	0.46	0.57	0.38	0.59	0.58	0.55	0.55	0.44	0.000084	0.27
Cadmium	0.000054	0.000091	0.000085	0.000065	0.0001	0.00023	0.0025	0.00032	0.00037	0.00043	0.0004	0.00028		
Calcium	47.5	44.9	45.9	48.1	50.7	69.6	38	71.5	71.4	67.9	69	61.8		66.7
Chromium	0.018	0.015	0.016	0.019	0.019	0.018	0.013	0.021	0.02	0.018	0.018	0.02	0.0011	0.014
Cobalt	0.00014	0.00017	0.00018		0.00015	0.00026	0.00019	0.00028	0.00028		0.00032	0.00021		0.00061
Copper	0.0037	0.22	0.18	0.032	0.03	0.013	0.0084	0.017	0.016	0.0097	0.0067	0.013		0.0039
Iron						0.028		0.021	0.022		0.028			
Lead	0.00011	0.0003	0.0003	0.0001	0.00013	0.00039	0.00041	0.00062	0.00065	0.00069	0.00065	0.00022	0.00021	
Magnesium	23	21.6	21.7	23.1	24.3	34.5	18.9	35.3	35.1	34.4	34.8	28.6		15.3
Manganese	0.0032	0.0078	0.0083	0.0046	0.0057	0.024	0.0056	0.022	0.022	0.031	0.083	0.002		0.12
Molybdenum	0.00019	0.0021	0.0022	0.00072	0.00091	0.0026	0.0018	0.0022	0.0022	0.0028	0.0032	0.002		0.0032
Nickel	0.0042	0.0048	0.0048	0.0046	0.0049	0.007	0.005	0.007	0.0073	0.0075	0.0086	0.0061		0.009
Potassium	1.7	1.6	1.4	1.4	1.7	2.3		2.4	2.5	2.3	2.5	1.5		10.7
Selenium	0.0016	0.0015	0.0014	0.0016	0.0013	0.0016	0.00078	0.0018	0.0018	0.0018	0.0017	0.0015	0.00011	0.0024
Silver										0.00008	0.000088			
Sodium	15.9	14.1	14.2	15	16.2	24.1	11.8	25.9	28.2	24.7	25.6	32.6		20.4
Vanadium	0.017	0.014	0.015	0.017	0.017	0.016	0.011	0.02	0.02	0.019	0.018	0.02	0.00029	0.007
Zinc	0.02	0.025	0.024	0.02	0.021	0.024	0.021	0.024	0.023	0.023	0.023	0.04		0.015
Semivolatile Organics - Method 8270 (mg/L)														
Benzyl alcohol														
bis(2-Ethylhexyl)phthalate	0.0036	0.0052	0.012	0.0048					0.14	0.005	0.0041			0.0043
Total Metals - Methods 6010/6020/7060/7470 (mg/L)														
Aluminum		0.052		0.014	0.021	0.058	0.069	0.086	0.49	0.12	0.16	0.044	0.011	0.73
Antimony														
Arsenic									0.0022	0.0028	0.0026			0.0038
Barium	0.45	0.4	0.38	0.45	0.43	0.51	0.36	0.55	0.62	0.53	0.54	0.45	0.00017	0.3
Cadmium	0.000073	0.00034		0.000074		0.00058	0.0041	0.00056	0.016	0.0013	0.0019	0.00042	0.0002	0.000074
Calcium	43.8	43.4	42.4	44.6	45.2	64.5	35.1	66.9	66	64.8	64.4	59.1	0.25	62.9
Chromium	0.0065	0.0077	0.014	0.0064	0.0061	0.005	0.0062	0.0075	0.045	0.0084	0.01	0.0049	0.00045	0.0014
Cobalt	0.0001	0.00047	0.00016	0.0001	0.00011	0.00021	0.00023	0.00026	0.00096	0.00033	0.00037	0.00018	0.000026	0.001

TABLE B-8
SECOND EVENT THIRD YEAR MONITORING
SURFACE WATER DETECTIONS
July 1997

	East Soldier Creek											West Soldier Creek		
	QE01	**QE02**	**QE03**	**QE04**	**QE05**	**QE06**	**QE07**	**QE08**	**QE09**	**QE10**	**QE11**	**QW05**	**QW06**	**QW07**
Copper	0.0017	0.51	0.26	0.042	0.042	0.026	0.018	0.036	0.058	0.02	0.017	0.016		0.0072
Iron		0.22	0.11			0.12	0.19	0.18	1	0.4	0.37	0.066		1.9
Lead	0.00035	0.0039	0.0022	0.00035	0.0011	0.0012	0.0031	0.0015	0.015	0.0021	0.0031	0.00075		0.0018
Magnesium	22.3	21.2	21.4	22.5	23.4	32.1	17.6	33.3	32.2	32.2	31.6	27.5		14.3
Manganese	0.0049	0.022	0.0098	0.0051	0.0064	0.029	0.0081	0.036	0.097	0.053	0.091	0.0042	0.00015	0.24
Molybdenum		0.0017	0.0021	0.00064	0.00095	0.0018	0.0015	0.0019	0.0021	0.0025	0.0026	0.0018		0.0026
Nickel	0.0021	0.0058	0.0029	0.0024	0.0023	0.004	0.0041	0.0043	0.013	0.0054	0.0068	0.004	0.00026	0.0068
Potassium	1.4	1.4	1.4	1.4	1.5	2.4	1.4	2.5	2.7	2.4	2.4	1.6		10.1
Selenium	0.00044	0.00089	0.00099	0.00048	0.00071	0.001	0.00043	0.0011	0.0011	0.0013	0.0012	0.001		0.0018
Silver									0.00062		0.00016			
Sodium	13.9	12.6	13.7	14.1	15.8	21.1	10.3	22.3	21.6	22	22.4	29.8		16.8
Vanadium	0.014	0.015	0.012	0.014	0.013	0.013	0.0084	0.016	0.017	0.016	0.014	0.016		0.0049
Zinc	0.018	0.075	0.033	0.02	0.02	0.021	0.031	0.024	0.047	0.022	0.023	0.042		0.021
Volatile Organics - Method 8260 (mg/L)														
Acetone		0.012	0.0073		0.003	0.0046	0.0065	0.0043	0.0031	0.0041		0.0055		0.0037
Chloroform														
Methylene chloride					0.0013	0.001	0.001	0.0012					0.0014	
Wet Chemistry - Methods 130.2/160.1/160.2/300.0/310.1/410.4/415.1 (mg/L)														
Alkalinity, Bicarb. as CaCO3 a	208	172	176	204	212	232	165	244	244	229	234	241		217
Alkalinity, Carb. as CaCO3 at	1.2	0.75										25.7		
Alkalinity, Total as CaCO3 at	209	173	176	204	212	232	165	244	244	230	234	267		217
Chemical Oxygen Demand (Regular)			24					7.9	7.3	9	14.1	9.3		26.8
Chloride	7.7	7.5	7.7	7.6	8.1	13.9	6.2	14.4	14.3	14.2	14.7	13.3		9.8
Hardness as CaCO3	190	176	182	192	202	285	154	295	291	285	287	252		206
Sulfate	5.5	27.9	31.9	13.9	19.7	83.2	4.4	90.8	88.9	86.7	87.9	13.6		20.8
Total Dissolved Solids	234	234	241	253	264	379	188	399	389	384	390	342		309
Total Organic Carbon	0.36	1.4	1.5	0.58	1.1	2.6	1.2	3	3.4	2.7	2.7	1.6		8.6
Total Suspended Solids						4	4	6	136	8	10.4			49.3

TABLE B-9
STATISTICAL EVALUATION OF ANALYTES
TENTATIVELY IDETIFIED IN SEDIMENT
THIRD YEAR LONG-TERM MONITORING

Analyte	Frequency of Detection	Average Result	Maximum Result	Minimum Result
Semivolatile Organics - Method 8270 (mg/kg)				
(2-Methylbutyl)cyclohexane	2	1.035	1.9	0.17
(6H)Cyclobuta[jk]phenanthrene	2	1.435	2.4	0.47
(Z)14-Tricosenyl formate	1	3.2	3.2	3.2
.beta.,.psi.-Carotene, 7,7',8,8',11,11',12,12',1!	2	0.47	0.77	0.17
.alpha.-Amyrin	1	1.2	1.2	1.2
.alpha.-Pinene	1	1.3	1.3	1.3
.beta.-Amyrin	1	0.82	0.82	0.82
1,1'-Biphenyl, 2,2',3,3',4,4',5,5',6,6'-decafluo!	1	2	2	2
1,1'-Biphenyl, 2,2',5,6-tetrachloro-	1	1.3	1.3	1.3
1,1'-Biphenyl, 2,3,4,4',6-pentachloro-	2	0.635	1.1	0.17
1,1':2',1"-Terphenyl, 2,5-dichloro-	2	2.7	3.5	1.9
1,1':4',1"-Terphenyl, 2,4,6-trichloro-	2	0.72	1.2	0.24
1,14-Docosanediol	1	0.9	0.9	0.9
1,2-Benzenedicarboxylic acid, bis(1-methylethyl)!	2	1.13	2	0.26
1,2-Benzenedicarboxylic acid,bis(8-methylnonyl)!	6	4.366666667	17	0.4
1,2-Benzenedicarboxylic acid,diisodecyl ester	6	9.934782609	26	0.17
1,2-Benzenedicarboxylic acid,diisooctyl ester	1	1.9	1.9	1.9
1,2-Benzenedicarboxylic acid,ditridecyl ester	9	7.491538462	56	0.17
1,22-Docosanediol	1	0.23	0.23	0.23
1,3,5-Triazine, 2-(butylthio)-4,6-bis(trichlorom!	1	0.26	0.26	0.26
1,3-Cyclohexadiene-1-carboxylic acid, 2,6,6-tri!	1	0.62	0.62	0.62
1,3-Dioxolane, 4-ethyl-5-octyl-2,2-bis(trifluoro	1	0.22	0.22	0.22
1,3-Dioxolane, 4-ethyl-5-octyl-2,2-bis(trifluoro!	1	1.5	1.5	1.5
1,4-Methanoazulene, decahydro-4,8,8-trimethyl-9!	2	0.625	0.74	0.51
1-Chlorohexadecane	4	1.4475	2.9	0.24
1-Cyclohexene-1-butanal, .alpha.,2,6,6-tetrameth	1	0.25	0.36	0.19
1-Cyclohexene-1-butanal, .alpha.,2,6,6-tetrameth!	1	0.43	0.43	0.43
1-Decene, 5-methyl-	1	7.4	7.4	7.4
1-Docosanol, acetate	1	5	5	5
1-Dodecene	1	0.18	0.18	0.18
1-Dotriacontanol	1	2.2	2.2	2.2
1-Eicosanol	1	1.2	1.2	1.2
1-Ethyl-2,2,6-trimethylcyclohexane	1	1.8	1.8	1.8
1-Hentetracontanol	2	1.53	2.9	0.16
1-Hexacosene	1	3.6	3.6	3.6
1-Hexadecyne	1	2.5	2.5	2.5
1-Hexanone, 1-(4-methyl-5-tridecyl-2-thienyl)-	1	8.9	8.9	8.9
1-Methyl-1-(p-methylphenyl)tetra chlorocyclotriph!	1	0.79	0.79	0.79
1-Naphthalene, decahydro-4a-methyl-1-methylene-!	1	0.59	0.59	0.59
1-Nonadecene	1	0.2	0.2	0.2
1-Phenylcyclohexanol-1	1	0.32	0.32	0.32
1-Undecene, 8-methyl-	1	0.18	0.18	0.18
10-Undecenoic acid, 2-(acetyloxy)-,methyl ester	1	0.7	0.7	0.7
10H-Phenothiaphosphine, 7-chloro-2-fluor-10-hydr!	3	1.318571429	2.6	0.37
11-Dodecen-1-ol, 2,4,6-trimethyl-,(R,R,R)-	1	1.5	1.5	1.5
11H-Benzo[a]fluorene	4	1.66	4.2	0.47
11H-Benzo[b]fluorene	3	1.676	3.2	0.34

TABLE B-9
STATISTICAL EVALUATION OF ANALYTES
TENTATIVELY IDETIFIED IN SEDIMENT
THIRD YEAR LONG-TERM MONITORING

Analyte	Frequency of Detection	Average Result	Maximum Result	Minimum Result
14-Pentadecenoic acid	1	0.52	0.52	0.52
17-Pentatriacontene	1	0.52	0.53	0.51
1H-3a,7-Methanoazulene, 2,3,4,7,8,8a,-hexahydro-	1	0.51	0.51	0.51
1H-Cyclopenta[1,3]cyclopropa[1,2]benzene, octah!	1	0.28	0.28	0.28
1H-Cycloprop[E]azulene, decahydro-1,1,7-trimethyl!	1	0.57	0.57	0.57
1H-Cycloprop[e]azulene, 1a,2,3,4,4a,-5,6,7b-oct!	1	0.96	0.96	0.96
1H-Indene, 2-butyl-5-hexyloctahydro-	3	1.824	3.8	0.32
1H-Indene, 5-butyl-6-hexyloctahydro-	11	1.439	5	0.16
1H-Indene, octahydro-2,2,4,4,7,7-hexamethyl-	1	6.1	6.1	6.1
1H-Indole, 2-methyl-3-phenyl-	1	3.4	3.4	3.4
1H-Pyrazole, 4-nitro-	1	0.45	0.45	0.45
2(1H)-Naphthalenone, octahydro-4a,7,7-trimethyl-!	2	1.973333333	4.1	0.22
2(1H)-Naphthalenone, octahydro-4a-methyl-7-(1-me	1	0.24	0.24	0.24
2(1H)-Naphthalenone, octahydro-4a-methyl-7-(1-me!	2	1.345	1.7	0.99
2(1H)-Naphthalenone, octahydro-8a -methyl-, cis-	1	3.7	3.7	3.7
2(1H)-Naphthalenone,octahydro-4a,4-dimethyl-3-(1!	1	4.4	4.4	4.4
2(1H)-Penanthrenone, 3,4,4a,9,10,10A-hexahydro-6!	2	0.77	1.3	0.24
2,3-Pentadienoic acid, 2-ethyl-4-phenyl-	1	0.61	0.61	0.61
2,6-Nonadienoic acid, 7-ethyl-9-(3-ethyl-3-methy!	1	1.9	1.9	1.9
2-(Acetoxymethyl)-3-(methyxycarbonyl)biphenylene	1	0.21	0.21	0.21
2-Butanone, 4-(2,6,6-trimethyl-2-cyclohexen-1-yl!	2	1.35	1.6	1.1
2-Butene, 1-chloro-3-methyl-	1	1.6	1.6	1.6
2-Chloro-4,6-di(4-chlorophenyl)pyrimidine	1	2.6	3.4	1.8
2-Cyclopenten-1-one, 3,4-dihydroxy-5-(3-methyl-2!	1	6.2	6.2	6.2
2-Dodecen-1-yl(-)succinic anhydride	28	2.272916667	9.2	0.17
2-Naphthalenol, 1,6-dibromo-	1	2.4	2.7	2.1
2-Nonylphenol	3	2.24	4.7	0.92
2-Octenal, (E)-	1	5.2	5.2	5.2
2-Pentanone, 4-hydroxy-4-methyl-	74	28.67702703	110	3.5
2-Propenoic acid, 2-cyano-3-[4-diethylamino)phen!	1	8.8	8.8	8.8
2-Propenoic acid, 3-[2,3-dihydro-3-[(4-methoxyph!	1	1	1	1
28-Nor-17.alpha.(H)-hopane	4	1.5725	2.1	0.99
28-Nor-17.beta.(H)-hopane	2	6.05	9.3	2.8
2H-Indol-2-one, 1,3-dihydro-	1	3.4	3.4	3.4
3,4-Dihydrocyclopenta(cd)pyrene (acepyrene)	1	1.5	1.5	1.5
3,5-Decadiene,2,2-dimethyl-, (Z,Z)-	1	1.9	1.9	1.9
3-Dodecene, (Z)-	1	1.4	1.4	1.4
3-Eicosene, (E)-	1	1.4	1.4	1.4
3-Hexadecene, (z)-	1	0.21	0.21	0.21
3-Hexene-2,5-diol	1	0.27	0.27	0.27
3-Methyl-p-anisaldehyde	1	5.35	7.9	2.8
3-Octadecene, (E)-	1	0.43	0.43	0.43
4,7-Dimethyl-1,10-phenanthroline	1	1.3	1.3	1.3
4,7-Methano-1H-indene, octahydro-	1	0.21	0.21	0.21
4-Hexenoic acid, 3-methyl-2,6-dioxo-	2	3.845	6.9	0.79
4-Undecene, 3-methyl-, (Z)-	1	5.8	5.8	5.8
4-Undecene, 4-methyl-, (Z)-	1	4.9	4.9	4.9
4H-1-Benzopyran-4-one, 2-(3,4-dihdroxyphenyl)6,8!	2	26.2	50	2.4
4H-Cyclopenta[def]phenanthrene	6	2.136666667	3.3	0.22

TABLE B-9
STATISTICAL EVALUATION OF ANALYTES
TENTATIVELY IDETIFIED IN SEDIMENT
THIRD YEAR LONG-TERM MONITORING

Analyte	Frequency of Detection	Average Result	Maximum Result	Minimum Result
5-Octadecene, (E)-	1	3.8	3.8	3.8
5.beta.-Cholest-23-ene, (Z)-	1	0.27	0.27	0.27
6-(3-Methyl-3-cyclohexenyl)-2-methyl-2,6-heptadi	1	0.49	0.49	0.49
6-Octen-1-ol, 3,7-dimethyl-, acetate	2	3.8975	6.4	0.69
6-Octenal, 3,7-dimethyl, (R)-	1	0.26	0.26	0.26
6H,8H-Benzo[10,11]chryseno[1,12-cd]pyran-6,8-dio!	2	14.2	24	4.4
7-Amino-2,3-dihydro-5-phenyl-1H-1,4-benzidazepi!	1	0.57	0.57	0.57
7-Tetradecene, (E)-	1	1.2	1.2	1.2
7H-Benz[de]anthracen-7-one	1	1.6	2	1.2
7H-Benzo[c]fluorene	1	0.94	0.94	0.94
8-Decenoic acid, 5-ethenyl-3,5,9-trimethyl-, met!	1	1.8	1.8	1.8
9,10-Anthracenedione	2	0.685	1.2	0.17
9,19-Cyclolanost-25-en-3-ol, 24-methyl-, (3.beta!	1	2	2.8	1.2
9-Borabicyclo[3.3.1]nonane, 9-hydroxy-	1	2.1	2.1	2.1
9-Eicosene, (E)-	1	0.28	0.28	0.28
9-Oxabicyclo[6.1.0]nonane, 1-methyl-,cis-	1	3.4	3.4	3.4
Acetamide, N-(2,6-dimethylphenyl)-	1	1.8	1.8	1.8
Acetamide, N-(3-methylphenyl)-	1	1	1	1
Acetamide, N-methyl-N-[4-[4-methoxy-1-hexahydrop!	3	7.12	27	3.1
Acetic acid, [4-(1,1-dimethylethyl)phenoxy]-, me!	1	1.9	1.9	1.9
Alnulin	1	1.4	1.4	1.4
Androst-5-en-3-ol, 4,4'dimethyl-, (3.beta.)-	1	1.3	1.3	1.3
Androstane-3,11,17-trione,(5.alpha.)-	1	0.27	0.27	0.27
Anthracene	2	0.227	0.4	0.054
Anthracene, 1-methyl-	3	1.366666667	1.5	1.3
Anthracene, 2-methyl-	2	0.356666667	0.7	0.18
Anthracene, 9-dodecyltetradecahydro-	2	1.05	1.9	0.2
Baccharane	2	1.07	1.4	0.74
Benzaldehyde, 4-hydroxy-3-methoxy-5-nitro-	1	6.3	6.3	6.3
Benzene, (2-methyl-1-propenyl)-	1	0.51	0.51	0.51
Benzene, 1,1',1"-[1-bromomethyl)-2-methoxy-1-et!	1	9.8	9.8	9.8
Benzene, 1,1'-(1,3-butadiyne-1,4-diyl)bis-	1	1.75	2	1.5
Benzene, 1,1'-ethylidenebis[3,4-dimethyl-	1	0.7	0.7	0.7
Benzene, 1,2,4,5-tetramethyl-	1	4.75	4.9	4.6
Benzene, 1,4-bis(1,1-dimethylethyl)-	1	4.4	4.4	4.4
Benzene, 1-methoxy-4-pentyl-	1	0.22	0.22	0.22
Benzene, 1-methyl-2-(1-methylethyl)-	1	3.8	3.8	3.8
Benzene, 4-ethyl-1,2-dimethyl-	1	0.96	0.96	0.96
Benzo(a)pyrene	2	3.85	4.6	3.1
Benzo(b)fluoranthene	4	4.31	9.4	0.43
Benzo(c)phenanthrene	3	0.5675	0.89	0.2
Benzo(e)pyrene	5	0.926666667	1.9	0.2
Benzo(j)fluoranthene	4	2.22	8.8	0.32
Benzo(k)fluoranthene	3	6.325	10	2.9
Benzo[a]pyrene, 4,5-dihydro-	1	1.3	1.3	1.3
Benzo[b]naphtho[2,3-d]furan	1	0.88	0.88	0.88
Benzo[b]naphtho[2,3-d]thiophene	1	1.9	1.9	1.9
Benzo[ghi]fluoranthene	3	1.026666667	2.1	0.25
Benzofuran, 2,3-dihydro-7-methoxy-3-methyl-5-(1-'	1	1.5	1.5	1.5

TABLE B-9
STATISTICAL EVALUATION OF ANALYTES
TENTATIVELY IDETIFIED IN SEDIMENT
THIRD YEAR LONG-TERM MONITORING

Analyte	Frequency of Detection	Average Result	Maximum Result	Minimum Result
Benzoic acid, 2-(4-methylbenzoyl)-	1	1.5	1.5	1.5
Bicyclo[5.1.0]octane, 8-(1 -methylethylidene)-	1	0.3	0.3	0.3
C(14a)-Homo-27-nor-14.beta.-gammaceran-3.alpha.-!	3	1.98	3.5	1
C(14a)-Homo-27-norgammacer-13-en-21-ol, 3-methox!	1	0.92	0.92	0.92
Caprolactam	1	0.25	0.25	0.25
Carbazole	6	0.918333333	1.8	0.22
Caryophyllene	1	0.22	0.22	0.22
Cholest-23-ene, (5.beta.)-	1	3.7	3.7	3.7
Choles..... ?-methylene-, (3.beta.,5.alpha.)-	4	1.153333333	2.4	0.61
Cholestan-3-one, 4,4-dimethyl-,(5.alpha.)-	3	0.836666667	1.9	0.26
Cholestane, 4,5-epoxy-, (4.alpha.,5.alpha.)-	1	3	3	3
Chromone, 3,5-dibromo-6-hydroxy-2-methyl-	8	1.142666667	4.2	0.2
Citronella	1	0.36	0.36	0.36
Cyclododecane	2	4.3	4.9	3.7
Cyclohexane, (1-ethylpropyl)-	2	2.3	3.4	1.2
Cyclohexane, (1-methylpropyl)-	2	3.4	4.1	2.7
Cyclohexane, (2-methylpropyl)-	1	0.46	0.46	0.46
Cyclohexane, 1,1-dimethyl-2,4-bis (1-methyletheny!	1	1.3	1.3	1.3
Cyclohexane, 1,2,3-trimethyl-,(1.alpha.,2.alph!	1	7	7	7
Cyclohexane, 1,2-dimethyl-, trans-	1	0.17	0.17	0.17
Cyclohexane, 1,2-dimethyl-3-pentyl-4 -propyl-	3	3.26	4.7	1.5
Cyclohexane, 1,3-dimethyl-, cis-	10	0.669	1.7	0.18
Cyclohexane, 1,4-dimethyl-	3	0.53	1.1	0.2
Cyclohexane, 1,4-dimethyl-, cis-	2	1.68	3.2	0.16
Cyclohexane, 1,4-dimethyl-, trans-	1	0.17	0.17	0.17
Cyclohexane, 1,5-diethenyl-2,3-dimethyl-	1	3.2	3.2	3.2
Cyclohexane, 1-(1,5-dimethylhexyl)-4-(4-methylpe!	1	1.7	1.7	1.7
Cyclohexane, 2,4-diethyl-1-methyl-	1	2.1	2.1	2.1
Cyclohexane, 2-butyl-1,1,3-trimethyl-	3	1.716666667	2.9	0.35
Cyclohexane, 2-propenyl-	1	1.8	1.8	1.8
Cyclohexane, 3,4-bis(1-methylethenyl)-1,1-dimeth!	1	9.5	9.5	9.5
Cyclohexane,1,2,4,5-tetraethyl-, (1.alpha.,2.alp!	3	1.79	3.2	0.27
Cyclohexanone	1	1.3	1.3	1.3
Cyclohexene, 1-methyl-4-(5-methyl-1 -methylene-4!	1	0.25	0.25	0.25
Cyclopentane, 1,1'-[3-(2-cyclopentylethyl)-1,5-p!	3	3.9	6.8	1.5
Cyclopentane, 1,1,3-trimethyl-	2	0.735	1.2	0.27
Cyclopentane, 1-butyl-2-pentyl-	1	3.1	3.1	3.1
Cyclopentane, 1-hexyl-3-methyl-	1	1.1	1.1	1.1
Cyclopentane, 1-methyl-3-(1-methylethyl)-	2	2.155	4	0.31
Cyclopentane, 1-pentyl-2-propyl-	2	3.25	4.5	2
Cyclopentanone, 2-methyl-4-(2-methylpropyl)-	1	0.77	0.77	0.77
Cyclopropa[5,6]-33-norgorgostan-3-ol, 3',6-dihyd	1	0.94	0.94	0.94
Cyclopropanecarboxylic acid, 2,2-dimethyl-3-(2-m!	1	1.1	1.1	1.1
Cyclopropanenonanoic acid, 2-[(2-butylcyclopropy!	1	7.8	7.8	7.8
Cyclotetracosane	1	5.6	5.6	5.6
Cyclotetradecane, 1,7,11-trimethyl-4-(1-methylet!	13	2.83962963	23	0.24
Cyclotriacontane	1	0.65	0.65	0.65
D-Friedoolean-14-ene, 3-methoxy-,(3.beta.)-	4	1.1175	1.4	0.87
D-Homoandrostane, (5.alpha.,13.alpha.)-	4	2.086666667	4.5	0.56

TABLE B-9
STATISTICAL EVALUATION OF ANALYTES
TENTATIVELY IDETIFIED IN SEDIMENT
THIRD YEAR LONG-TERM MONITORING

Analyte	Frequency of Detection	Average Result	Maximum Result	Minimum Result
Decahydro-9-ethyl-4,4,8,10-tetramethyl naphthalen	1	0.38	0.38	0.38
Decane	2	3.13	5.8	0.46
Decane, 2,6,7-trimethyl-	4	4.775	8.4	0.2
Decane, 2-methyl-	3	2.3975	4.2	0.29
Decane, 3,8-dimethyl-	1	6	6	6
Decane, 3-methyl-	2	3.123333333	5.1	0.57
Decane, 4-methyl-	1	3.3	3.3	3.3
Decane, 5-propyl-	1	2.7	2.7	2.7
Decanedioic acid, didecyl ester	1	1.3	1.3	1.3
Dextro-camphoric acid	1	0.2	0.2	0.2
Dibenz(a,j)acridine	1	0.33	0.33	0.33
Dibenzothiophene	3	0.766666667	1	0.32
Docosane	1	1.2	1.2	1.2
Docosane, 2,21-dimethyl-	1	9.6	9.6	9.6
Dodecane	7	4.058888889	11	0.74
Dodecane, 2,6,10-trimethyl-	9	2.632	6.8	0.19
Dodecane, 2,6,11-trimethyl-	5	3.018333333	9.1	0.18
Dodecane, 2,7,10-trimethyl-	1	0.98	0.98	0.98
Dodecane, 2-cyclohexyl-, 2-cyclohexyl-	1	2.6	2.6	2.6
Dodecane, 2-methyl-8-propyl-	1	6.9	6.9	6.9
Dodecane, 4,6-dimethyl-	1	2.8	2.8	2.8
Dodecane, 6-methyl-	2	1.055	1.8	0.31
Eicosane	8	8.297272727	39	0.24
Eicosane, 9-octyl-	1	13	13	13
Ergost-22-en-3-ol, (3.beta.,5.alpha.,22E,24R)-	1	0.38	0.38	0.38
Ergost-5-en-3-ol, (3.beta.)-	1	10	10	10
Estra-1,3,5(10)-trien-17-one, 2-hydroxy-	1	1.1	1.1	1.1
Estra-1,3,5(10)-trien-17-one, 3-hydroxy-	1	0.82	0.82	0.82
Ethanoic acid, S-methyl ester	2	0.505	0.66	0.35
Formamide, N'-(m-acetylphenyl)-N,N-dimethyl-	1	0.56	0.56	0.56
Fumariline	1	6.6	6.6	6.6
Halogenated Compound	3	2.14	3	1.3
Heneicosane	1	2.9	2.9	2.9
Heneicosane, 3-methyl-	1	0.79	0.79	0.79
Heptacosane	8	5.250909091	22	0.25
Heptadecane	7	2.671428571	7.7	0.21
Heptadecane, 2,6,10,15-tetramethyl-	4	5.785	12	0.94
Heptadecane, 2,6-dimethyl-	4	3.5075	5.6	0.63
Heptadecane, 3-methyl-	1	0.87	0.87	0.87
Heptadecane, 9-octyl-	1	1.9	1.9	1.9
Heptane, 3-ethyl-2-methyl-	1	1.3	1.3	1.3
Heptane, 4-ethyl-	1	4.6	4.6	4.6
Hexacosane	6	4.631428571	13	0.26
Hexadecane	7	2.27	5.5	0.17
Hexadecane, 2,6,10,14-tetramethyl-	3	3.875	7.2	0.2
Hexadecane, 2,6,11,15-tetramethyl-	3	0.77	1.7	0.2
Hexadecane, 2-methyl-	3	2.19	4.5	0.27
Hexadecane, 7-methyl-	2	0.615	0.98	0.25
Hexadecanoic acid	1	0.34	0.34	0.34

TABLE B-9
STATISTICAL EVALUATION OF ANALYTES
TENTATIVELY IDETIFIED IN SEDIMENT
THIRD YEAR LONG-TERM MONITORING

Analyte	Frequency of Detection	Average Result	Maximum Result	Minimum Result
Hexadecanoic acid, 2-hydroxy-,methyl ester	8	1.895	11	0.27
Hexanoic acid	1	0.33	0.33	0.33
Hexatriacontane	5	1.126	2.8	0.37
Imidazole, 2,5-dibromo-4-phenyl-	1	0.19	0.19	0.19
Imidazole, 4-amino-5-ethyloxycarbonyl-	1	1.3	1.3	1.3
Isooctane, (ethenyloxy)-	1	0.39	0.39	0.39
Longifolenaldehyde	3	1.363333333	2.1	0.29
Lupeol	1	0.35	0.35	0.35
N-Cyano-N',N',N'',N''-tetrameth; 1-1 3,5-triazine!	1	0.23	0.23	0.23
Naphthalene, 1,2,3,4,4a,5,6,8a-octahydro-7-methyl	1	0.29	0.29	0.29
Naphthalene, 1,2,3,4-tetrachloro-	4	0.878888889	2.6	0.21
Naphthalene, 1,2,3,4-tetrahydro-1,6-dimethyl-4-!	2	1.285	1.9	0.67
Naphthalene, 1,2,3,5,6,7,8,8a-octahydro-1,8a-di!	1	0.69	0.69	0.69
Naphthalene, 1,3,7-trichloro-	3	1.03	1.7	0.44
Naphthalene, 1,8-dimethyl-	1	2.3	2.3	2.3
Naphthalene, 2,3,6-trichloro-	3	0.7875	1.3	0.31
Naphthalene, 2,3-dichloro-	1	1	1	1
Naphthalene, 2,3-dimethyl-	1	0.55	0.55	0.55
Naphthalene, 2,7-dichloro-	1	0.18	0.18	0.18
Naphthalene, decahydro-2,6-dimethyl-	1	0.35	0.35	0.35
Naphthalene, decahydro-2-methyl-	4	1.3225	2.9	0.19
Neopentylideneecyclohexane	2	1.645	2.6	0.69
Nitrogen Compound	1	2.3	2.3	2.3
Nonacosane	1	6.4	6.4	6.4
Nonadecane	1	4.7	4.7	4.7
Nonadecane, 9-methyl-	2	8.9	14	3.8
Nonahexacontanoic acid	3	8.606666667	21	0.72
Nonane, 3-methyl-	1	8	8	8
Octadecane	8	5.887777778	30	0.18
Octadecane, 1-bromo-	1	0.3	0.3	0.3
Octadecane, 1-chloro-	3	1.566666667	3.4	0.55
Octadecane, 2,6-dimethyl-	1	13	13	13
Octadecane, 2-methyl-	2	3.25	4.2	2.3
Octane	1	4.7	4.7	4.7
Octane, 2,3,7-trimethyl-	7	2.051428571	4.6	0.2
Olean-12-ene	1	0.63	0.63	0.63
Olean-18-ene	1	0.82	0.82	0.82
Oxirane, hexadecyl-	2	0.295	0.4	0.19
Oxygenated Hydrocarbon	11	2.41	17	0.17
P-Terphenyl, 2,4,4",6-tetrachloro-	1	1.7	1.7	1.7
Pentacosane	4	4.303333333	15	0.2
Pentadecane	4	1.97	4.9	0.25
Pentadecane, 2,6,10,14-tetramethyl-	6	3.273333333	11	0.54
Pentalene, octahydro-1-(2-octyldecyl)-	3	1.173333333	2.6	0.21
Pentatriacontane	1	0.52	0.52	0.52
Perylene	6	4.04125	7.8	0.33
Phenanthrene, 2-methyl-	1	1.1	1.1	1.1
Phenanthrene, 3-methyl-	1	0.99	0.99	0.99
Phenanthrene, 7-ethenyl-1,2,3,4,4a,4b,5-,6,7,8,8	1	0.65	0.65	0.65

TABLE B-9
STATISTICAL EVALUATION OF ANALYTES
TENTATIVELY IDETIFIED IN SEDIMENT
THIRD YEAR LONG-TERM MONITORING

Analyte	Frequency of Detection	Average Result	Maximum Result	Minimum Result
Phenol, 2,4-bis(1-methylethyl)-	1	0.75	0.75	0.75
Phenol, 2-(1,1-dimethylethyl)-	3	2.166666667	3.2	1.5
Phenol, 2-(1,1-dimethylethyl)-5-methyl-	1	0.85	0.85	0.85
Phenol, 2-methyl-5-(1-methylethyl)-	1	1.4	1.4	1.4
Phenol, 4,4'-butylidenebis[2-(1,1-dimethylethyl)	1	1.1	1.1	1.1
Phenol, 4-(1,1,3,3-tetramethylbutyl)-	8	1.0375	2.6	0.17
Phenol, 4-(1,1-dimethylpropyl)-	4	1.621666667	3.7	0.93
Phenol, 4-(2,2,3,3-tetramethylbutyl)-	3	2.476666667	6.1	0.42
Phenol, 4-(2,2,4-trimethylpentyl)-	1	1.9	1.9	1.9
Phenol, 4-(2-methylpropyl)-	1	6.3	6.3	6.3
Phenol, 4-dodecyl-	1	5.7	5.7	5.7
Phenol, 4-nonyl-	5	2.55	5.9	0.28
Phenol, 5-methoxy-2-(3,4,9,10-tetrahydro-8,8-dim!	1	1.9	1.9	1.9
Phenol, chloro-4-(1,1-dimethylethyl)-,acetate	1	0.29	0.29	0.29
Phenol, m-tert-butyl-	2	1.803333333	3.2	0.61
Phenol, nonyl-	9	1.944444444	6.8	0.21
Phenol-2,6-dimethoxy-4-(2-propenyl)-	1	2.3	2.3	2.3
Phenothiazino[4,3-c]phenothiazine,8,16-dihydro-	1	0.27	0.27	0.27
Phosphonic acid, 1,3-propanediylbis-,tetraethyl !	1	1.9	1.9	1.9
Phosphonic difluoride,(pentafluorophenyl)-	1	1.6	1.6	1.6
Phosphoric acid, 2-ethylhexyl diphenyl ester	3	3.3	5.8	1.5
Phthalic acid, allyl ethyl ester	1	21	21	21
Phthalic anhydride	1	1.8	1.8	1.8
Polynuclear Aromatic Hydrocarbon	3	1.3125	2.5	0.44
Propane, 1,3-bis(ethylthio)-	2	3.33	9.5	0.21
Pyrazine, 3,5-diethyl-2-methyl-	1	3.2	3.2	3.2
Saturated Hydrocarbon	5	3.374736842	11	0.18
Silane, chlorotripropyl-	1	0.7	0.7	0.7
Siloxane	12	1.27375	14	0.17
Squalene	7	2.703333333	5.8	0.19
Stannane, chlorotris(2-methylpropyl)-	2	4.4	4.9	3.9
Sterol	7	0.567826087	1.9	0.19
Stigmast-4-en-3-one	2	0.405	0.47	0.34
Stigmast-5-en-3-ol-, (3.beta.,24S)-	2	4.5	6.9	2.1
Sulfur, mol. (S8)	3	4.425	11	1.1
Terphenyl, 2,5,4-trichloro-	1	0.41	0.41	0.41
Tetracosane	10	4.9525	15	0.18
Tetracosatetraene, 2,6,10,15,19,23-hexamethyl-	1	0.35	0.35	0.35
Tetradecanal	1	3.7	3.7	3.7
Tetradecane	3	2.826666667	8	0.23
Tetradecane, 1-bromo-	1	0.47	0.47	0.47
Tetratetracontane	2	1.565	2.7	0.43
Toluene, 4-acetylamino-	2	2.45	2.5	2.4
Triacontane	1	0.98	0.98	0.98
Tricosane	4	7.118	14	0.19
Tricyclo[4.3.0.07,9]nonane, 2,2,5,5,8,8-hexamet'	4	3.5425	7	0.27
Tricyclo[4.3.1.13,8]undecane,1-chloro-	1	2.7	2.7	2.7
Tricyclo[4.3.1.13,8]undecane-3-carboxylic acid, '	1	5.6	5.6	5.6
Tridecane	8	1.73	6.9	0.17

TABLE B-9
STATISTICAL EVALUATION OF ANALYTES
TENTATIVELY IDETIFIED IN SEDIMENT
THIRD YEAR LONG-TERM MONITORING

Analyte	Frequency of Detection	Average Result	Maximum Result	Minimum Result
Tridecane, 2-methyl-	1	1.3	1.3	1.3
Tridecane, 5-propyl-	2	3.675	6.4	0.95
Tridecane, 6-propyl-	1	0.38	0.38	0.38
Tridecanol	1	0.73	0.73	0.73
Triphenylene	1	1.7	1.7	1.7
Tritetracontane	2	5.95	8.4	3.5
Undecane, 2,5-dimethyl-	1	2	2	2
Undecane, 2,6-dimethyl-	10	3.176	7.4	0.25
Undecane, 2,8-dimethyl-	1	7.6	7.6	7.6
Undecane, 2-methyl-	1	3.7	3.7	3.7
Undecane, 3,6-dimethyl-	2	1.52	2.2	0.84
Undecane, 3,8-dimethyl-	1	0.89	0.89	0.89
Undecane, 4,6-dimethyl-	1	0.63	0.63	0.63
Undecane, 4-methyl-	1	4.2	4.2	4.2
Unknown	1	0.41	0.41	0.41
Unsaturated Hydrocarbon	1	3.3	3.3	3.3
Urs-12-ene	1	0.91	0.91	0.91
Urs-12-ene, 3-methoxy-, (3.beta.)-	1	0.47	0.47	0.47
Urs-20-en-16-ol, (16.beta.,18.alpha.,19.alpha.)-	1	2.9	2.9	2.9
Vitamin E	2	8.6	14	3.2
[1,2'-Binaphthalene]-5,5',8,8'-tetrone, 1',4-dih	2	0.253333333	0.4	0.17
[1,2'-Binaphthalene]-5,5',8,8'-tetrone, 1',4-dih!	24	2.92375	40	0.18
d-Galactitol, 2-(acetylmethylamino)-2-deoxy-3,4,!	1	2	2	2
d-Homoandrostane, (5.alpha.,13.alpha.)-	4	2.328	5.9	0.71
n-Amylcyclohexane	2	6.75	10	3.5
n-Octacosane	1	0.76	0.76	0.76
Volatile Organics - Method 8260 (mg/kg)				
.alpha.-Pinene	1	0.0065	0.0065	0.0065
1,1,3,3,5-pentamenthylcyclohexane	1	0.43	0.43	0.43
1,1,4-Trimethylcyclohexane	1	0.047	0.047	0.047
1,2,4-Trimethylbenzene	2	0.0075	0.0085	0.0065
1,2-Dichlorobenzene	3	0.0395	0.088	0.0075
1,3-Dichlorobenzene	1	0.022	0.022	0.022
1,4-Dichlorobenzene	3	0.017666667	0.03	0.01
1-Decene	1	0.017	0.017	0.017
1-Ethyl-3-methylcyclohexane (c,t)	2	0.0295	0.034	0.025
1-Methylnaphthalene	2	0.00945	0.012	0.0069
1-Pentene, 2,4,4-trimethyl-	1	0.013	0.013	0.013
1-bromoadamantane	1	1.9	1.9	1.9
1H-Indene, 2,3-dihydro-1,3-dimethyl-	1	0.0082	0.0082	0.0082
2-Bicyclo[4.3.1]decan-10-one	1	0.022	0.022	0.022
2-Octene, 2,6-dimethyl-	1	0.017	0.017	0.017
3,5-Dimethyl-3-heptene	1	0.083	0.083	0.083
4,7-Methano-1H-indene, octahydro-	1	0.022	0.022	0.022
4-Undecene, 6-methyl-	1	0.066	0.066	0.066
4-tert-Butyltoluene	1	0.0072	0.0072	0.0072
5-Eicosyne	1	0.0023	0.0023	0.0023
Adamantane, 1,3-dimethyl-	2	0.8155	1.6	0.031
Aromatic Hydrocarbon	7	0.036087[illegible]5	0.17	0.006

TABLE B-9
STATISTICAL EVALUATION OF ANALYTES
TENTATIVELY IDETIFIED IN SEDIMENT
THIRD YEAR LONG-TERM MONITORING

Analyte	Frequency of Detection	Average Result	Maximum Result	Minimum Result
Azulene	1	0.33	0.33	0.33
Benzene, (1,1-dimethylpropyl)-	1	0.012	0.012	0.012
Benzene, (1-ethylpropyl)-	1	0.0075	0.0075	0.0075
Benzene, (2-methyl-1-butenyl)-	1	0.0088	0.0088	0.0088
Benzene, 1,2,4,5-tetramethyl-	4	0.02775	0.049	0.015
Benzene, 1,2-diethyl-	1	0.035	0.035	0.035
Benzene, 1,3-dimethyl-5-(1-methylethyl)-	2	0.0069	0.0071	0.0067
Benzene, 1,4-diethyl-	2	0.00695	0.0073	0.0066
Benzene, 1-ethyl-2,3-dimethyl-	2	0.0285	0.035	0.022
Benzene, 1-ethyl-2,4-dimethyl-	1	0.0074	0.0074	0.0074
Benzene, 1-ethyl-3,5-dimethyl-	2	0.0195	0.028	0.011
Benzene, 1-ethyl-3-(1-methylethyl)-	1	0.023	0.023	0.023
Benzene, 1-ethyl-4-(1-methylethyl)-	1	0.018	0.018	0.018
Benzene, 1-methyl-2-(1-methylethyl)-	1	0.036	0.036	0.036
Benzene, 1-methyl-3-(1-methylethyl)-	2	1.664	3.3	0.028
Benzene, 1-methyl-3-propyl-	1	0.012	0.012	0.012
Benzene, 2,4-dimethyl-1-(1-methylethyl)-	1	0.0082	0.0082	0.0082
Benzene, 2-ethyl-1,3-dimethyl-	1	0.057	0.057	0.057
Benzene, 4-ethyl-1,2-dimethyl-	3	0.0132	0.022	0.0068
Benzene, diethyl-	1	0.0093	0.0093	0.0093
Bicyclo[2.2.1]heptane, 2-butyl-	1	0.0066	0.0066	0.0066
Bicyclo[3.3.1]nonane	1	0.015	0.015	0.015
Bicyclo[4.1.0]heptan-3-one,4,7,7-trimethyl-, [1R!	3	0.1319	0.35	0.0067
Bromofluoromethane	1	0.047	0.047	0.047
Cyclic Hydrocarbon	20	0.132186957	1.4	0.0066
Cyclodecene	1	0.06	0.06	0.06
Cycloheptane, methyl-	2	0.0585	0.098	0.019
Cyclohexane, (2-methylpropyl)-	1	0.012	0.012	0.012
Cyclohexane, 1,1,2,3-tetramethyl-	2	0.0115	0.012	0.011
Cyclohexane, 1,1,2-trimethyl-	1	0.081	0.081	0.081
Cyclohexane, 1,1,3,5-tetramethyl-,trans-	1	0.0081	0.0081	0.0081
Cyclohexane, 1,1,3-trimethyl-	3	0.834	2.4	0.037
Cyclohexane, 1,1-dimethyl-2-propyl-	1	0.076	0.076	0.076
Cyclohexane, 1,2,3-trimethyl-	1	0.055	0.055	0.055
Cyclohexane, 1,2,3-trimethyl-, (1.alpha.,2.alpha.	1	0.018	0.018	0.018
Cyclohexane, 1,2,3-trimethyl-,(1.alpha.,2.beta!	3	0.0221	0.04	0.0063
Cyclohexane, 1,2,4-trimethyl-	2	0.036	0.055	0.017
Cyclohexane, 1,2,4-trimethyl-,(1.alpha.,2.beta.,!	1	0.027	0.027	0.027
Cyclohexane, 1,2-diethyl-1-methyl-	2	0.7215	1.4	0.043
Cyclohexane, 1,2-diethyl-3-methyl-	3	0.551666667	1.2	0.025
Cyclohexane, 1,2-dimethyl-, cis-	1	0.0072	0.0072	0.0072
Cyclohexane, 1,3-dimethyl-, trans-	2	1.612	3.2	0.024
Cyclohexane, 1,4-dimethyl-	1	0.046	0.046	0.046
Cyclohexane, 1-ethyl-2-methyl-, cis-	1	0.064	0.064	0.064
Cyclohexane, 1-ethyl-4-methyl-, cis-	2	0.067	0.11	0.024
Cyclohexane, 1-ethyl-4-methyl-,trans-	3	1.98525	5	0.008
Cyclohexane, 1-methyl-2-propyl-	3	0.089333333	0.18	0.015
Cyclohexane, 2,4-diethyl-1-methyl-	1	0.099	0.099	0.099
Cyclohexane, 2-butyl-1,1,3-trimethyl-	3	0.075966667	0.12	0.0079

TABLE B-9
STATISTICAL EVALUATION OF ANALYTES
TENTATIVELY IDETIFIED IN SEDIMENT
THIRD YEAR LONG-TERM MONITORING

Analyte	Frequency of Detection	Average Result	Maximum Result	Minimum Result
Cyclohexane, 2-ethyl-1,3-dimethyl-	1	0.011	0.011	0.011
Cyclohexane, butyl-	4	0.5294	1.7	0.019
Cyclohexane, ethyl-	1	0.012	0.012	0.012
Cyclohexane, hexyl-	1	0.021	0.021	0.021
Cyclohexane, methyl-	3	4.486666667	13	0.15
Cyclohexane, pentyl-	2	0.16	0.19	0.13
Cyclohexane, propyl-	2	1.563	3.1	0.026
Cyclohexanone, 2-ethyl-	2	0.0715	0.091	0.052
Cyclohexanone, 2-methyl-5-(1-methylethenyl)-, tr'	1	0.02	0.02	0.02
Cyclopentane, 1-methyl-1-(2-methyl-2-propenyl)-	1	0.124	0.22	0.028
Cyclopentane, 1-methyl-2-propyl-	1	0.012	0.012	0.012
Cyclopentane, 1-methyl-3-(2-methylpropyl)-	2	0.649	1.2	0.098
Cyclopropane, 1,2-dimethyl-, trans-	1	0.0081	0.0081	0.0081
Cyclopropane, 1-(2-methylbutyl)-1-methylpropyl)-	1	0.033	0.033	0.033
Cyclopropane, 1-butyl-1-methyl-2-propyl-	1	0.039	0.039	0.039
Cyclopropane, 1-methyl-2-pentyl-	1	0.014	0.014	0.014
Cylohexane, 1,3,5-trimethyl-	1	0.0069	0.0069	0.0069
Decane	2	0.0099	0.013	0.0068
Decane, 2,6,6-trimethyl-	1	0.011	0.011	0.011
Decane, 2-methyl-	2	0.0071	0.0076	0.0066
Decane, 3,3,4-trimethyl-	1	0.16	0.16	0.16
Decane, 3-methyl-	6	0.245	1.2	0.027
Decane, 4-methyl-	10	0.14818	0.4	0.0068
Dodecane	1	0.032	0.032	0.032
Dodecane, 3-methyl-	1	0.084	0.084	0.084
Dodecane, 6-methyl-	2	0.079	0.12	0.038
Heptane	1	6.4	6.4	6.4
Heptane, 2-methyl-	1	12	12	12
Heptane, 3-ethyl-2-methyl-	6	0.064833333	0.17	0.014
Heptane, 4-propyl-	1	0.007	0.007	0.007
Heptane, 5-ethyl-2-methyl-	1	0.013	0.013	0.013
Hexane	1	0.17	0.17	0.17
Naphthalene	6	0.047	0.19	0.006
Naphthalene, 1,2,3,4-tetrahydro-1-methyl-	1	0.0093	0.0093	0.0093
Naphthalene, 1,2,3,4-tetrahydro-5-methyl-	1	0.0095	0.0095	0.0095
Naphthalene, decahydro-	5	0.04478	0.14	0.0069
Naphthalene, decahydro-, trans-	9	0.484444444	3.7	0.017
Naphthalene, decahydro-2,3-dimethyl-	2	0.0385	0.063	0.014
Naphthalene, decahydro-2,6-dimethyl-	1	0.32	0.32	0.32
Naphthalene, decahydro-2-methyl-	7	0.463571429	2.7	0.016
Nonane, 2-methyl-	1	0.029	0.029	0.029
Nonane, 2-methyl-3-methylene-	2	0.02445	0.039	0.0099
Nonane, 3-methyl-	2	0.00895	0.011	0.0069
Nonane, 5-butyl-	1	0.091	0.091	0.091
Nonane, 5-methyl-5-propyl-	1	0.069	0.069	0.069
Octane	1	3.6	3.6	3.6
Octane, 2,3,6-trimethyl-	1	0.085	0.085	0.085
Octane, 2,6-dimethyl-	4	0.02425	0.036	0.011
Octane, 3,6-dimethyl-	5	0.5768	2.5	0.059

TABLE B-9
STATISTICAL EVALUATION OF ANALYTES
TENTATIVELY IDETIFIED IN SEDIMENT
THIRD YEAR LONG-TERM MONITORING

Analyte	Frequency of Detection	Average Result	Maximum Result	Minimum Result
Octane, 3-ethyl-	1	0.094	0.094	0.094
Octane, 3-methyl-	1	2	2	2
Octane, 4-ethyl-	2	0.0515	0.071	0.032
Octane, 4-methyl-	1	3.7	3.7	3.7
Octane, 6-ethyl-2-methyl-	2	0.0455	0.053	0.038
Oxygenated Hydrocarbon	6	0.071833333	0.17	0.009
Saturated Hydrocarbon	16	0.123297297	0.76	0.006
Siloxane	10	0.099966667	0.47	0.0078
Tricyclo[3.3.1.13,7]decane	1	0.95	0.95	0.95
Tridecane	1	0.42	0.42	0.42
Undecane	2	0.0255	0.026	0.025
Undecane, 4,6-dimethyl-	1	0.17	0.17	0.17
Undecane, 4,7-dimethyl-	1	0.024	0.024	0.024
Undecane, 6,6-dimethyl-	1	0.015	0.015	0.015
Unknown	8	1.049507692	8.1	0.0096
Unsaturated Hydrocarbon	8	0.126636364	0.49	0.015
cis-1,2-Dichloroethene	1	0.018	0.018	0.018
cis-1-Ethyl-3-methyl-cyclohexane	2	0.035	0.057	0.013
n-Amylcyclohexane	1	0.12	0.12	0.12
n-Propylbenzene	1	0.011	0.011	0.011
p-Isopropyltoluene (p-Cymene)	3	0.031975	0.069	0.0061
sec-Butylbenzene	1	0.016	0.016	0.016

TABLE B-10

MAXIMUM DETECTED CONCENTRATIONS AND ASSOCIATED SAMPLE LOCATIONS
FOR TENTATIVELY IDENTIFIED COMPOUNDS IN SEDIMENT SAMPLES
THIRD YEAR LONG-TERM MONITORING

Analyte	Result	Client Description	Footnotes	% Water
Semivolatile Organics (mg/kg)				
(2-Methylbutyl)cyclohexane	1.9	SC-QE06-SD-1002 (0.50,1.00)	J	41.4
(6H)Cyclobuta[jk]phenanthrene	2.4	SC-QE03-SD-1001 (0.00,0.50)	J	19.0
(Z)14-Tricosenyl formate	3.2	SC-QW02-SD-902 (0.50,1.00)	J	22.5
.alpha.-Amyrin	1.2	SC-QE09-SD-1001 (0.00,0.50)	J	38.7
.alpha.-Pinene	1.3	SC-QE01-SD-1001 (0.00,0.50)	J	55.6
.beta.-Amyrin	0.82	SC-QE09-SD-1001 (0.00,0.50)	J	38.7
.Psi.,.psi.-Carotene, 7,7',8,8',11,11',12,12',1!	0.77	SC-QW03-SD-1001 (0.00,0.50)	Jz	16.1
[1,2'-Binaphthalene]-5,5',8,8'-tetrone, 1',4-dih	0.4	SC-QW01-SD-1003 (0.00,1.50)	Jz	13.7
[1,2'-Binaphthalene]-5,5',8,8'-tetrone, 1',4-dih!	40	SC-QE06-SD-902 (0.50,1.00)	Jz	46.6
1,1'-Biphenyl, 2,2',3,3',4,4',5,5',6,6'-decafluo!	2	SC-QE07-SD-1002 (0.50,1.00)	Jz	19
1,1'-Biphenyl, 2,2',5,6-tetrachloro-	1.3	SC-QW03-SD-903 (1.00,2.00)	J	23.9
1,1'-Biphenyl, 2,3,4,4',6-pentachloro-	1.1	SC-QW03-SD-903 (1.00,2.00)	J	23.9
1,1':2',1"-Terphenyl, 2,5-dichloro-	3.5	SC-QE07-SD-901 (0.00,0.50)	J	17.7
1,1':4',1"-Terphenyl, 2,4,6-trichloro-	1.2	SC-QE07-SD-1002 (0.50,1.00)	J	19
1,14-Docosanediol	0.9	SC-QE09-SD-1002 (0.50,1.00)	J	26
1,2-Benzenedicarboxylic acid, bis(1-methylethyl)!	2	SC-QW03-SD-902 (0.50,1.00)	Jz	52.5
1,2-Benzenedicarboxylic acid,bis(8-methylnonyl)!	17	SC-QW04-SD-901 (0.00,0.50)	Jz	58.3
1,2-Benzenedicarboxylic acid,diisodecyl ester	26	SC-QW04-SD-901 (0.00,0.50)	J	58.3
1,2-Benzenedicarboxylic acid,diisooctyl ester	1.9	SC-QW04-SD-902 (0.50,1.00)	J	43.1
1,2-Benzenedicarboxylic acid,ditridecyl ester	56	SC-QW03-SD-902 (0.50,1.00)	J	52.5
1,22-Docosanediol	0.23	SC-QW06-SD-901 (0.00,0.50)	J	16.3
1,3,5-Triazine, 2-(butylthio)-4,6-bis(trichlorom!	0.26	SC-QE07-SD-1001 (0.00,0.50)	Jz	21
1,3-Cyclohexadiene-1-carboxylic acid, 2,6,6-tri!	0.62	SC-QE11-SD-902 (0.50,1.00)	Jz	13.5
1,3-Dioxolane, 4-ethyl-5-octyl-2,2-bis(trifluoro	0.22	SC-QW04-SD-1003 (0.00,3.00)	Jz	22.9
1,3-Dioxolane, 4-ethyl-5-octyl-2,2-bis(trifluoro!	1.5	SC-QW02-SD-901 (0.00,0.50)	Jz	69.8
1,4-Methanoazulene, decahydro-4,8,8-trimethyl-9!	0.74	SC-QW04-SD-1001 (0.00,0.50)	Jz	28.1
1-Chlorohexadecane	2.9	SC-QE08-SD-1001 (0.00,0.50)	J	60.1
1-Cyclohexene-1-butanal, .alpha.,2,6,6-tetrameth	0.36	SC-QW04-SD-1002 (0.50,1.00)	Jz	16.6
1-Cyclohexene-1-butanal, .alpha.,2,6,6-tetrameth!	0.43	SC-QE05-SD-1001 (0.00,0.50)	Jz	23.1
1-Decene, 5-methyl-	7.4	SC-QE08-SD-1002 (0.50,1.00)	J	30.9
1-Docosanol, acetate	5	SC-QE06-SD-902 (0.50,1.00)	J	46.6
1-Dodecene	0.18	SC-QE05-SD-901 (0.00,0.50)	J	18.0
1-Dotriacontanol	2.2	SC-QW04-SD-903 (2.00,2.50)	J	38.5
1-Eicosanol	1.2	SC-QE02-SD-902 (0.50,1.00)	J	17.0
1-Ethyl-2,2,6-trimethylcyclohexane	1.8	SC-QE10-SD-901 (0.00,0.50)	J	16.0
1-Hentetracontanol	2.9	SC-QE08-SD-1001 (0.00,0.50)	J	60.1
1-Hexacosene	3.6	SC-QW02-SD-901 (0.00,0.50)	J	69.8
1-Hexadecyne	2.5	SC-QE10-SD-901 (0.00,0.50)	J	16.0
1-Hexanone, 1-(4-methyl-5-tridecyl-2-thienyl)-	8.9	SC-QE06-SD-1002 (0.50,1.00)	J	41.4
1-Methyl-1-(p-methylphenyl)tetra chlorocyclotriph!	0.79	SC-QE07-SD-902 (0.50,1.00)	Jz	11.8
1-Naphthalene, decahydro-4a-methyl-1-methylene-!	0.59	SC-QW01-SD-901 (0.00,0.50)	Jz	21.2
1-Nonadecene	0.2	SC-QW03-SD-902 (0.50,1.00)	J	52.5
1-Phenylcyclohexanol-1	0.32	SC-QW07-SD-1001 (0.00,0.50)	J	10.2
1-Undecene, 8-methyl-	0.18	SC-QE05-SD-1001 (0.00,0.50)	J	23.1
10-Undecenoic acid, 2-(acetyloxy)-,methyl ester	0.7	SC-QE01-SD-1001 (0.00,0.50)	J	55.6
10H-Phenothiaphosphine, 7-chloro-2-fluor-10-hydr!	2.6	SC-QE07-SD-1002 (0.50,1.00)	Jz	19
11-Dodecen-1-ol, 2,4,6-trimethyl-,(R,R,R)-	1.5	SC-QE10-SD-901 (0.00,0.50)	J	16.0
11H-Benzo[a]fluorene	4.2	SC-QE08-SD-1001 (0.00,0.50)	J	60.1
11H-Benzo[b]fluorene	3.2	SC-QW05-SD-901 (0.00,0.50)	J	25.0
14-Pentadecenoic acid	0.52	SC-QE07-SD-1002 (0.50,1.00)	J	19
17-Pentatriacontene	0.53	SC-QE09-SD-901 (0.00,0.50)	J	22.4

TABLE B-10
MAXIMUM DETECTED CONCENTRATIONS AND ASSOCIATED SAMPLE LOCATIONS FOR TENTATIVELY IDENTIFIED COMPOUNDS IN SEDIMENT SAMPLES THIRD YEAR LONG-TERM MONITORING

Analyte	Result	Client Description	Footnotes	% Water
1H-3a,7-Methanoazulene, 2,3,4,7,8,8a,-hexahydro-	0.51	SC-QW03-SD-1001 (0.00,0.50)	Jz	16.1
1H-Cyclopenta[1,3]cyclopropa[1,2]benzene, octah!	0.28	SC-QW07-SD-1001 (0.00,0.50)	Jz	10.2
1H-Cycloprop[e]azulene, 1a,2,3,4,4a,-5,6,7b-oct!	0.96	SC-QW03-SD-1001 (0.00,0.50)	Jz	16.1
1H-Cycloprop[E]azulene, decahydro-1,1,7-trimethyl!	0.57	SC-QW01-SD-901 (0.00,0.50)	Jz	21.2
1H-Indene, 2-butyl-5-hexyloctahydro-	3.8	SC-QE03-SD-901 (0.00,0.50)	J	44.4
1H-Indene, 5-butyl-6-hexyloctahydro-	5	SC-QE02-SD-901 (0.00,0.50)	J	15.6
1H-Indene, octahydro-2,2,4,4,7,7-hexamethyl-	6.1	SC-QW04-SD-903 (2.00,2.50)	J	38.5
1H-Indole, 2-methyl-3-phenyl-	3.4	SC-QW04-SD-903 (2.00,2.50)	J	38.5
1H-Pyrazole, 4-nitro-	0.45	SC-QE01-SD-901 (0.00,0.50)	J	17.1
2(1H)-Naphthalenone, octahydro-4a,7,7-trimethyl-!	4.1	SC-QW02-SD-901 (0.00,0.50)	Jz	69.8
2(1H)-Naphthalenone, octahydro-4a-methyl-7-(1-me	0.24	SC-QW04-SD-1002 (0.50,1.00)	Jz	16.6
2(1H)-Naphthalenone, octahydro-4a-methyl-7-(1-me!	1.7	SC-QE01-SD-1001 (0.00,0.50)	Jz	55.6
2(1H)-Naphthalenone, octahydro-8a -methyl-, cis-	3.7	SC-QE08-SD-901 (0.00,0.50)	J	59.1
2(1H)-Naphthalenone,octahydro-4a,4-dimethyl-3-(1!	4.4	SC-QE06-SD-1002 (0.50,1.00)	Jz	41.4
2(1H)-Penanthrenone, 3,4,4a,9,10,10A-hexahydro-6!	1.3	SC-QE07-SD-1002 (0.50,1.00)	Jz	19
2,3-Pentadienoic acid, 2-ethyl-4-phenyl-	0.61	SC-QW07-SD-1001 (0.00,0.50)	J	10.2
2,6-Nonadienoic acid, 7-ethyl-9-(3-ethyl-3-methy!	1.9	SC-QW02-SD-901 (0.00,0.50)	Jz	69.8
2-(Acetoxymethyl)-3-(methyxycarbonyl)biphenylene	0.21	SC-QW04-SD-1003 (0.00,3.00)	J	22.9
2-Butanone, 4-(2,6,6-trimethyl-2-cyclohexen-1-yl!	1.6	SC-QW02-SD-901 (0.00,0.50)	J	69.8
2-Butene, 1-chloro-3-methyl-	1.6	SC-QE01-SD-1001 (0.00,0.50)	J	55.6
2-Chloro-4,6-di(4-chlorophenyl)pyrimidine	3.4	SC-QE07-SD-901 (0.00,0.50)	J	17.7
2-Cyclopenten-1-one, 3,4-dihydroxy-5-(3-methyl-2!	6.2	SC-QE06-SD-1002 (0.50,1.00)	Jz	41.4
2-Dodecen-1-yl(-)succinic anhydride	9.2	SC-QW04-SD-901 (0.00,0.50)	J	58.3
2-Naphthalenol, 1,6-dibromo-	2.7	SC-QE07-SD-901 (0.00,0.50)	J	17.7
2-Nonylphenol	4.7	SC-QE09-SD-1002 (0.50,1.00)	J	26
2-Octenal, (E)-	5.2	SC-QE06-SD-902 (0.50,1.00)	J	46.6
2-Pentanone, 4-hydroxy-4-methyl-	110	SC-QE01-SD-1001 (0.00,0.50)	JAB	55.6
2-Propenoic acid, 2-cyano-3-[4-diethylamino)phen!	8.8	SC-QE01-SD-1001 (0.00,0.50)	Jz	55.6
2-Propenoic acid, 3-[2,3-dihydro-3-[(4-methoxyph!	1	SC-QE09-SD-1002 (0.50,1.00)	Jz	26
28-Nor-17.alpha.(H)-hopane	2.1	SC-QW02-SD-901 (0.00,0.50)	J	69.8
28-Nor-17.alpha.(H)-hopane	2.1	SC-QW02-SD-902 (0.50,1.00)	J	22.5
28-Nor-17.beta.(H)-hopane	9.3	SC-QE03-SD-901 (0.00,0.50)	J	44.4
2H-Indol-2-one, 1,3-dihydro-	3.4	SC-QE03-SD-901 (0.00,0.50)	J	44.4
3,4-Dihydrocyclopenta(cd)pyrene (acepyrene)	1.5	SC-QW05-SD-901 (0.00,0.50)	J	25.0
3,5-Decadiene,2,2-dimethyl-, (Z,Z)-	1.9	SC-QW02-SD-902 (0.50,1.00)	J	22.5
3-Dodecene, (Z)-	1.4	SC-QE06-SD-903 (1.00,1.50)	J	25.8
3-Eicosene, (E)-	1.4	SC-QW02-SD-901 (0.00,0.50)	J	69.8
3-Hexadecene, (z)-	0.21	SC-QE05-SD-1001 (0.00,0.50)	J	23.1
3-Hexene-2,5-diol	0.27	SC-QW07-SD-901 (0.00,0.50)	J	24.3
3-Methyl-p-anisaldehyde	7.9	SC-QW05-SD-901 (0.00,0.50)	J	25.0
3-Octadecene, (E)-	0.43	SC-QE09-SD-901 (0.00,0.50)	J	22.4
4,7-Dimethyl-1,10-phenanthroline	1.3	SC-QE07-SD-901 (0.00,0.50)	J	17.7
4,7-Methano-1H-indene, octahydro-	0.21	SC-QW06-SD-901 (0.00,0.50)	J	16.3
4-Hexenoic acid, 3-methyl-2,6-dioxo-	6.9	SC-QE06-SD-1002 (0.50,1.00)	J	41.4
4-Undecene, 3-methyl-, (Z)-	5.8	SC-QE08-SD-901 (0.00,0.50)	J	59.1
4-Undecene, 4-methyl-, (Z)-	4.9	SC-QE08-SD-1002 (0.50,1.00)	J	30.9
4H-1-Benzopyran-4-one, 2-(3,4-dihdroxyphenyl)6,8!	50	SC-QE06-SD-902 (0.50,1.00)	Jz	46.6
4H-Cyclopenta[def]phenanthrene	3.3	SC-QE07-SD-901 (0.00,0.50)	J	17.7
5-Octadecene, (E)-	3.8	SC-QW02-SD-901 (0.00,0.50)	J	69.8
5.beta.-Cholest-23-ene, (Z)-	0.27	SC-QW04-SD-1002 (0.50,1.00)	J	16.6
6-(3-Methyl-3-cyclohexenyl)-2-methyl -2,6-heptadi	0.49	SC-QW03-SD-1001 (0.00,0.50)	J	16.1
6-Octen-1-ol, 3,7-dimethyl-, acetate	6.4	SC-QW02-SD-902 (0.50,1.00)	J	22.5

TABLE B-10
MAXIMUM DETECTED CONCENTRATIONS AND ASSOCIATED SAMPLE LOCATIONS
FOR TENTATIVELY IDENTIFIED COMPOUNDS IN SEDIMENT SAMPLES
THIRD YEAR LONG-TERM MONITORING

Analyte	Result	Client Description		Footnotes	% Water
6-Octenal, 3,7-dimethyl, (R)-	0.26	SC-QE11-SD-902	(0.50,1.00)	J	13.5
6H,8H-Benzo[10,11]chryseno[1,12-cd]pyran-6,8-dio!	24	SC-QE06-SD-902	(0.50,1.00)	Jz	46.6
7-Amino-2,3-dihydro-5-phenyl-1H-1,4-benzidazepi!	0.57	SC-QE09-SD-901	(0.00,0.50)	Jz	22.4
7-Tetradecene, (E)-	1.2	SC-QE10-SD-901	(0.00,0.50)	J	16.0
7H-Benz[de]anthracen-7-one	2	SC-QW05-SD-901	(0.00,0.50)	J	25.0
7H-Benzo[c]fluorene	0.94	SC-QE03-SD-1001	(0.00,0.50)	J	19.0
8-Decenoic acid, 5-ethenyl-3,5,9-trimethyl-, met!	1.8	SC-QE09-SD-1001	(0.00,0.50)	Jz	38.7
9,10-Anthracenedione	1.2	SC-QW05-SD-901	(0.00,0.50)	J	25.0
9,19-Cyclolanost-25-en-3-ol, 24-methyl-, (3.beta!	2.8	SC-QE01-SD-1001	(0.00,0.50)	Jz	55.6
9-Borabicyclo[3.3.1]nonane, 9-hydroxy-	2.1	SC-QE10-SD-901	(0.00,0.50)	J	16.0
9-Eicosene, (E)-	0.28	SC-QE05-SD-1001	(0.00,0.50)	J	23.1
9-Oxabicyclo[6.1.0]nonane, 1-methyl-,cis-	3.4	SC-QE06-SD-901	(0.00,0.50)	J	66.0
Acetamide, N-(2,6-dimethylphenyl)-	1.8	SC-QE10-SD-902	(0.50,1.00)	J	16.3
Acetamide, N-(3-methylphenyl)-	1	SC-QE11-SD-901	(0.00,0.50)	J	16.8
Acetamide, N-methyl-N-[4-[4-methoxy-1-hexahydrop!	27	SC-QE06-SD-902	(0.50,1.00)	Jz	46.6
Acetic acid, [4-(1,1-dimethylethyl)phenoxy]-, me!	1.9	SC-QW02-SD-902	(0.50,1.00)	Jz	22.5
Alnulin	1.4	SC-QW04-SD-1002	(0.50,1.00)	J	16.6
Androst-5-en-3-ol, 4,4'dimethyl-, (3.beta.)-	1.3	SC-QW03-SD-1001	(0.00,0.50)	J	16.1
Androstane-3,11,17-trione,(5.alpha.)-	0.27	SC-QE07-SD-1001	(0.00,0.50)	J	21
Anthracene	0.4	SC-QW04-SD-901	(0.00,0.50)	J	58.3
Anthracene, 1-methyl-	1.5	SC-QW04-SD-902	(0.50,1.00)	J	43.1
Anthracene, 2-methyl-	0.7	SC-QE03-SD-1001	(0.00,0.50)	J	19.0
Anthracene, 9-dodecyltetradecahydro-	1.9	SC-QE02-SD-1001	(0.00,0.50)	J	26.8
Baccharane	1.4	SC-QW04-SD-1002	(0.50,1.00)	J	16.6
Benzaldehyde, 4-hydroxy-3-methoxy-5-nitro-	6.3	SC-QW03-SD-901	(0.00,0.50)	J	33.8
Benzene, (2-methyl-1-propenyl)-	0.51	SC-QW07-SD-1001	(0.00,0.50)	J	10.2
Benzene, 1,1',1"-[1-bromomethyl)-2-methoxy-1-et!	9.8	SC-QE01-SD-1001	(0.00,0.50)	Jz	55.6
Benzene, 1,1'-(1,3-butadiyne-1,4-diyl)bis-	2	SC-QW05-SD-901	(0.00,0.50)	J	25.0
Benzene, 1,1'-ethylidenebis[3,4-dimethyl-	0.7	SC-QE01-SD-901	(0.00,0.50)	J	17.1
Benzene, 1,2,4,5-tetramethyl-	4.9	SC-QE08-SD-1002	(0.50,1.00)	J	30.9
Benzene, 1,4-bis(1,1-dimethylethyl)-	4.4	SC-QW04-SD-903	(2.00,2.50)	J	38.5
Benzene, 1-methoxy-4-pentyl-	0.22	SC-QE10-SD-903	(0.00,3.00)	J	16.8
Benzene, 1-methyl-2-(1-methylethyl)-	3.8	SC-QE08-SD-1002	(0.50,1.00)	J	30.9
Benzene, 4-ethyl-1,2-dimethyl-	0.96	SC-QW07-SD-1001	(0.00,0.50)	J	10.2
Benzo(a)pyrene	4.6	SC-QE07-SD-902	(0.50,1.00)	J	11.8
Benzo(b)fluoranthene	9.4	SC-QE06-SD-901	(0.00,0.50)	J	66.0
Benzo(c)phenanthrene	0.89	SC-QE03-SD-1001	(0.00,0.50)	J	19.0
Benzo(e)pyrene	1.9	SC-QE03-SD-1001	(0.00,0.50)	J	19.0
Benzo(j)fluoranthene	8.8	SC-QE03-SD-901	(0.00,0.50)	J	44.4
Benzo(k)fluoranthene	10	SC-QE07-SD-901	(0.00,0.50)	J	17.7
Benzo[a]pyrene, 4,5-dihydro-	1.3	SC-QW05-SD-901	(0.00,0.50)	J	25.0
Benzo[b]naphtho[2,3-d]furan	0.88	SC-QE07-SD-1002	(0.50,1.00)	J	19
Benzo[b]naphtho[2,3-d]thiophene	1.9	SC-QW05-SD-901	(0.00,0.50)	J	25.0
Benzo[ghi]fluoranthene	2.1	SC-QW05-SD-901	(0.00,0.50)	J	25.0
Benzofuran, 2,3-dihydro-7-methoxy-3-methyl-5-(1-!	1.5	SC-QE07-SD-1002	(0.50,1.00)	Jz	19
Benzoic acid, 2-(4-methylbenzoyl)-	1.5	SC-QW05-SD-901	(0.00,0.50)	J	25.0
Bicyclo[5.1.0]octane, 8-(1-methylethylidene)-	0.3	SC-QW03-SD-1001	(0.00,0.50)	J	16.1
C(14a)-Homo-27-nor-14.beta.-gammaceran-3.alpha.-!	3.5	SC-QE02-SD-1001	(0.00,0.50)	Jz	26.8
C(14a)-Homo-27-norgammacer-13-en-21-ol, 3-methox!	0.92	SC-QE09-SD-1001	(0.00,0.50)	Jz	38.7
Caprolactam	0.25	SC-QE01-SD-901	(0.00,0.50)	J	17.1
Carbazole	1.8	SC-QW05-SD-901	(0.00,0.50)	J	25.0
Caryophyllene	0.22	SC-QW07-SD-901	(0.00,0.50)	J	24.3

TABLE B-10
MAXIMUM DETECTED CONCENTRATIONS AND ASSOCIATED SAMPLE LOCATIONS
FOR TENTATIVELY IDENTIFIED COMPOUNDS IN SEDIMENT SAMPLES
THIRD YEAR LONG-TERM MONITORING

Analyte	Result	Client Description		Footnotes	% Water
Cholest-23-ene, (5.beta.)-	3.7	SC-QE03-SD-901	(0.00,0.50)	J	44.4
Cholestan-3-ol, 2-methylene-, (3.beta.,5.alpha.)-	2.4	SC-QE02-SD-1001	(0.00,0.50)	J	26.8
Cholestan-3-one, 4,4-dimethyl-,(5.alpha.)-	1.9	SC-QE09-SD-1002	(0.50,1.00)	J	26
Cholestane, 4,5-epoxy-, (4.alpha.,5.alpha.)-	3	SC-QE09-SD-1002	(0.50,1.00)	J	26
Chromone, 3,5-dibromo-6-hydroxy-2-methyl-	4.2	SC-QE07-SD-1002	(0.50,1.00)	J	19
Citronella	0.36	SC-QW06-SD-901	(0.00,0.50)	J	16.3
Cyclododecane	4.9	SC-QE06-SD-901	(0.00,0.50)	J	66.0
Cyclohexane, (1-ethylpropyl)-	3.4	SC-QE08-SD-901	(0.00,0.50)	J	59.1
Cyclohexane, (1-methylpropyl)-	4.1	SC-QE08-SD-1001	(0.00,0.50)	J	60.1
Cyclohexane, (2-methylpropyl)-	0.46	SC-QE09-SD-901	(0.00,0.50)	J	22.4
Cyclohexane, 1,1-dimethyl-2,4-bis (1-methyletheny!	1.3	SC-QE01-SD-1001	(0.00,0.50)	Jz	55.6
Cyclohexane, 1,2,3-trimethyl-,(1.alpha.,2.alph!	7	SC-QE08-SD-1002	(0.50,1.00)	Jz	30.9
Cyclohexane, 1,2-dimethyl-, trans-	0.17	SC-QW06-SD-1001	(0.00,0.50)	J	12.1
Cyclohexane, 1,2-dimethyl-3-pentyl-4 -propyl-	4.7	SC-QW04-SD-903	(2.00,2.50)	J	38.5
Cyclohexane, 1,3-dimethyl-, cis-	1.7	SC-QE07-SD-902	(0.50,1.00)	J	11.8
Cyclohexane, 1,4-dimethyl-	1.1	SC-QW03-SD-903	(1.00,2.00)	J	23.9
Cyclohexane, 1,4-dimethyl-, cis-	3.2	SC-QW03-SD-902	(0.50,1.00)	J	52.5
Cyclohexane, 1,4-dimethyl-, trans-	0.17	SC-QW02-SD-1001	(0.00,0.50)	J	10.4
Cyclohexane, 1,5-diethenyl-2,3-dimethyl-	3.2	SC-QE09-SD-1002	(0.50,1.00)	J	26
Cyclohexane, 1-(1,5-dimethylhexyl)-4-(4-methylpe!	1.7	SC-QE07-SD-901	(0.00,0.50)	Jz	17.7
Cyclohexane, 2,4-diethyl-1-methyl-	2.1	SC-QE10-SD-901	(0.00,0.50)	J	16.0
Cyclohexane, 2-butyl-1,1,3-trimethyl-	2.9	SC-QE08-SD-1002	(0.50,1.00)	J	30.9
Cyclohexane, 2-propenyl-	1.8	SC-QE06-SD-903	(1.00,1.50)	J	25.8
Cyclohexane, 3,4-bis(1-methylethenyl)-1,1-dimeth!	9.5	SC-QE08-SD-901	(0.00,0.50)	Jz	59.1
Cyclohexane,1,2,4,5-tetraethyl-, (1.alpha.,2.alp!	3.2	SC-QW02-SD-901	(0.00,0.50)	Jz	69.8
Cyclohexanone	1.3	SC-QE06-SD-903	(1.00,1.50)	J	25.8
Cyclohexene, 1-methyl-4-(5-methyl-1 -methylene-4!	0.25	SC-QW03-SD-1001	(0.00,0.50)	Jz	16.1
Cyclopentane, 1,1'-[3-(2-cyclopentylethyl)-1,5-p!	6.8	SC-QW02-SD-902	(0.50,1.00)	Jz	22.5
Cyclopentane, 1,1,3-trimethyl-	1.2	SC-QE10-SD-901	(0.00,0.50)	J	16.0
Cyclopentane, 1-butyl-2-pentyl-	3.1	SC-QE08-SD-1001	(0.00,0.50)	J	60.1
Cyclopentane, 1-hexyl-3-methyl-	1.1	SC-QE09-SD-901	(0.00,0.50)	J	22.4
Cyclopentane, 1-methyl-3-(1-methylethyl)-	4	SC-QE06-SD-902	(0.50,1.00)	J	46.6
Cyclopentane, 1-pentyl-2-propyl-	4.5	SC-QE08-SD-901	(0.00,0.50)	J	59.1
Cyclopentanone, 2-methyl-4-(2-methylpropyl)-	0.77	SC-QE09-SD-901	(0.00,0.50)	J	22.4
Cyclopropa[5,6]-33-norgorgostan-3-ol, 3',6-dihyd	0.94	SC-QW03-SD-1001	(0.00,0.50)	J	16.1
Cyclopropanecarboxylic acid, 2,2-dimethyl-3-(2-m!	1.1	SC-QE01-SD-1001	(0.00,0.50)	Jz	55.6
Cyclopropanenonanoic acid, 2-[(2-butylcyclopropy!	7.8	SC-QW05-SD-901	(0.00,0.50)	Jz	25.0
Cyclotetracosane	5.6	SC-QW03-SD-902	(0.50,1.00)	J	52.5
Cyclotetradecane, 1,7,11-trimethyl-4-(1-methylet!	23	SC-QE06-SD-902	(0.50,1.00)	Jz	46.6
Cyclotriacontane	0.65	SC-QE08-SD-902	(0.50,1.00)	J	22.2
D-Friedoolean-14-ene, 3-methoxy-,(3.beta.)-	1.4	SC-QE11-SD-1001	(0.00,0.50)	J	12.4
d-Galactitol, 2-(acetylmethylamino)-2-deoxy-3,4,!	2	SC-QE03-SD-1001	(0.00,0.50)	Jz	19.0
D-Homoandrostane, (5.alpha.,13.alpha.)-	4.5	SC-QE02-SD-1001	(0.00,0.50)	J	26.8
d-Homoandrostane, (5.alpha.,13.alpha.)-	5.9	SC-QE03-SD-901	(0.00,0.50)	J	44.4
Decahydro-9-ethyl-4,4,8,10-tetramethyl naphthalen	0.38	SC-QW04-SD-1002	(0.50,1.00)	J	16.6
Decane	5.8	SC-QE06-SD-902	(0.50,1.00)	J	46.6
Decane, 2,6,7-trimethyl-	8.4	SC-QE06-SD-902	(0.50,1.00)	J	46.6
Decane, 2-methyl-	4.2	SC-QE08-SD-1002	(0.50,1.00)	J	30.9
Decane, 3,8-dimethyl-	6	SC-QE08-SD-1002	(0.50,1.00)	J	30.9
Decane, 3-methyl-	5.1	SC-QE08-SD-1002	(0.50,1.00)	J	30.9
Decane, 4-methyl-	3.3	SC-QE08-SD-1002	(0.50,1.00)	J	30.9
Decane, 5-propyl-	2.7	SC-QE10-SD-901	(0.00,0.50)	J	16.0

TABLE B-10
MAXIMUM DETECTED CONCENTRATIONS AND ASSOCIATED SAMPLE LOCATIONS
FOR TENTATIVELY IDENTIFIED COMPOUNDS IN SEDIMENT SAMPLES
THIRD YEAR LONG-TERM MONITORING

Analyte	Result	Client Description	Footnotes	% Water
Decanedioic acid, didecyl ester	1.3	SC-QE10-SD-901 (0.00,0.50)	J	16.0
Dextro-camphoric acid	0.2	SC-QW04-SD-1002 (0.50,1.00)	J	16.6
Dibenz(a,j)acridine	0.33	SC-QE07-SD-901 (0.00,0.50)	J	17.7
Dibenzothiophene	1	SC-QE03-SD-1001 (0.00,0.50)	J	19.0
Docosane	1.2	SC-QE03-SD-1001 (0.00,0.50)	J	19.0
Docosane, 2,21-dimethyl-	9.6	SC-QE08-SD-1001 (0.00,0.50)	J	60.1
Dodecane	11	SC-QE08-SD-1002 (0.50,1.00)	J	30.9
Dodecane, 2,6,10-trimethyl-	6.8	SC-QE08-SD-901 (0.00,0.50)	J	59.1
Dodecane, 2,6,11-trimethyl-	9.1	SC-QE06-SD-902 (0.50,1.00)	J	46.6
Dodecane, 2,7,10-trimethyl-	0.98	SC-QE06-SD-903 (1.00,1.50)	J	25.8
Dodecane, 2-cyclohexyl-, 2-cyclohexyl-	2.6	SC-QE06-SD-1001 (0.00,0.50)	J	40.9
Dodecane, 2-methyl-8-propyl-	6.9	SC-QE08-SD-1002 (0.50,1.00)	J	30.9
Dodecane, 4,6-dimethyl-	2.8	SC-QE06-SD-1002 (0.50,1.00)	J	41.4
Dodecane, 6-methyl-	1.8	SC-QW04-SD-903 (2.00,2.50)	J	38.5
Eicosane	39	SC-QE06-SD-902 (0.50,1.00)	J	46.6
Eicosane, 9-octyl-	13	SC-QE08-SD-1001 (0.00,0.50)	J	60.1
Ergost-22-en-3-ol, (3.beta.,5.alpha.,22E,24R)-	0.38	SC-QW01-SD-901 (0.00,0.50)	J	21.2
Ergost-5-en-3-ol, (3.beta.)-	10	SC-QE01-SD-1001 (0.00,0.50)	J	55.6
Estra-1,3,5(10)-trien-17-one, 2-hydroxy-	1.1	SC-QE07-SD-1002 (0.50,1.00)	J	19
Estra-1,3,5(10)-trien-17-one, 3-hydroxy-	0.82	SC-QE07-SD-1002 (0.50,1.00)	J	19
Ethanoic acid, S-methyl ester	0.66	SC-QE10-SD-903 (0.00,3.00)	J	16.8
Formamide, N'-(m-acetylphenyl)-N,N-dimethyl-	0.56	SC-QE01-SD-901 (0.00,0.50)	J	17.1
Fumariline	6.6	SC-QE08-SD-1002 (0.50,1.00)	J	30.9
Halogenated Compound	3	SC-QE10-SD-901 (0.00,0.50)	J	16.0
Heneicosane	2.9	SC-QE08-SD-1001 (0.00,0.50)	Jz	60.1
Heneicosane, 3-methyl-	0.79	SC-QE05-SD-1001 (0.00,0.50)	J	23.1
Heptacosane	22	SC-QE08-SD-1001 (0.00,0.50)	J	60.1
Heptadecane	7.7	SC-QE08-SD-1001 (0.00,0.50)	J	60.1
Heptadecane, 2,6,10,15-tetramethyl-	12	SC-QE06-SD-902 (0.50,1.00)	J	46.6
Heptadecane, 2,6-dimethyl-	5.6	SC-QE08-SD-1001 (0.00,0.50)	J	60.1
Heptadecane, 3-methyl-	0.87	SC-TR01-SD-901 (0.00,0.50)	J	31.5
Heptadecane, 9-octyl-	1.9	SC-QW03-SD-1001 (0.00,0.50)	J	16.1
Heptane, 3-ethyl-2-methyl-	1.3	SC-QE06-SD-903 (1.00,1.50)	J	25.8
Heptane, 4-ethyl-	4.6	SC-QE08-SD-1002 (0.50,1.00)	J	30.9
Hexacosane	13	SC-QE08-SD-1001 (0.00,0.50)	J	60.1
Hexadecane	5.5	SC-QE08-SD-1001 (0.00,0.50)	J	60.1
Hexadecane, 2,6,10,14-tetramethyl-	7.2	SC-QE06-SD-1001 (0.00,0.50)	J	40.9
Hexadecane, 2,6,11,15-tetramethyl-	1.7	SC-QE06-SD-903 (1.00,1.50)	J	25.8
Hexadecane, 2-methyl-	4.5	SC-QE06-SD-1001 (0.00,0.50)	J	40.9
Hexadecane, 7-methyl-	0.98	SC-QW03-SD-903 (1.00,2.00)	J	23.9
Hexadecanoic acid	0.34	SC-QW02-SD-1001 (0.00,0.50)	J	10.4
Hexadecanoic acid, 2-hydroxy-,methyl ester	11	SC-QE06-SD-1001 (0.00,0.50)	J	40.9
Hexanoic acid	0.33	SC-QW07-SD-1001 (0.00,0.50)	J	10.2
Hexatriacontane	2.8	SC-QE06-SD-1002 (0.50,1.00)	J	41.4
Imidazole, 2,5-dibromo-4-phenyl-	0.19	SC-QE07-SD-1001 (0.00,0.50)	J	21
Imidazole, 4-amino-5-ethyloxycarbonyl-	1.3	SC-QE07-SD-902 (0.50,1.00)	J	11.8
Isooctane, (ethenyloxy)-	0.39	SC-QE08-SD-902 (0.50,1.00)	J	22.2
Longifolenaldehyde	2.1	SC-QW02-SD-902 (0.50,1.00)	J	22.5
Lupeol	0.35	SC-QW04-SD-1002 (0.50,1.00)	J	16.6
n-Amylcyclohexane	10	SC-QE08-SD-1002 (0.50,1.00)	J	30.9
N-Cyano-N',N',N'',N''-tetramethyl-1,3,5-triazine'	0.23	SC-QE07-SD-1001 (0.00,0.50)	Jz	21
n-Octacosane	0.76	SC-QE07-SD-1002 (0.50,1.00)	J	19

TABLE B-10
MAXIMUM DETECTED CONCENTRATIONS AND ASSOCIATED SAMPLE LOCATIONS
FOR TENTATIVELY IDENTIFIED COMPOUNDS IN SEDIMENT SAMPLES
THIRD YEAR LONG-TERM MONITORING

Analyte	Result	Client Description		Footnotes	% Water
Naphthalene, 1,2,3,4,4a,5,6,8a-octahydro-7-methyl	0.29	SC-QW03-SD-1001	(0.00,0.50)	J	16.1
Naphthalene, 1,2,3,4-tetrachloro-	2.6	SC-QE07-SD-901	(0.00,0.50)	J	17.7
Naphthalene, 1,2,3,4-tetrahydro-1,6-dimethyl-4-!	1.9	SC-QE01-SD-901	(0.00,0.50)	Jz	17.1
Naphthalene, 1,2,3,5,6,7,8,8a-octahydro-1,8a-di!	0.69	SC-QE07-SD-1001	(0.00,0.50)	Jz	21
Naphthalene, 1,3,7-trichloro-	1.7	SC-QE07-SD-1002	(0.50,1.00)	J	19
Naphthalene, 1,8-dimethyl-	2.3	SC-QW04-SD-903	(2.00,2.50)	J	38.5
Naphthalene, 2,3,6-trichloro-	1.3	SC-QE07-SD-901	(0.00,0.50)	J	17.7
Naphthalene, 2,3-dichloro-	1	SC-QE09-SD-1001	(0.00,0.50)	J	38.7
Naphthalene, 2,3-dimethyl-	0.55	SC-QE07-SD-1002	(0.50,1.00)	J	19
Naphthalene, 2,7-dichloro-	0.18	SC-QE11-SD-902	(0.50,1.00)	J	13.5
Naphthalene, decahydro-2,6-dimethyl-	0.35	SC-QE08-SD-902	(0.50,1.00)	J	22.2
Naphthalene, decahydro-2-methyl-	2.9	SC-QE02-SD-1001	(0.00,0.50)	J	26.8
Neopentylidenecyclohexane	2.6	SC-QW04-SD-903	(2.00,2.50)	J	38.5
Nitrogen Compound	2.3	SC-QE03-SD-901	(0.00,0.50)	J	44.4
Nonacosane	6.4	SC-QE06-SD-901	(0.00,0.50)	J	66.0
Nonadecane	4.7	SC-QE06-SD-901	(0.00,0.50)	J	66.0
Nonadecane, 9-methyl-	14	SC-QE08-SD-1001	(0.00,0.50)	J	60.1
Nonahexacontanoic acid	21	SC-QE08-SD-1001	(0.00,0.50)	J	60.1
Nonane, 3-methyl-	8	SC-QE08-SD-901	(0.00,0.50)	J	59.1
Octadecane	30	SC-QE08-SD-1001	(0.00,0.50)	J	60.1
Octadecane, 1-bromo-	0.3	SC-QE11-SD-902	(0.50,1.00)	J	13.5
Octadecane, 1-chloro-	3.4	SC-QE08-SD-1001	(0.00,0.50)	J	60.1
Octadecane, 2,6-dimethyl-	13	SC-QE08-SD-1002	(0.50,1.00)	J	30.9
Octadecane, 2-methyl-	4.2	SC-QE10-SD-901	(0.00,0.50)	J	16.0
Octane	4.7	SC-QE08-SD-1002	(0.50,1.00)	J	30.9
Octane, 2,3,7-trimethyl-	4.6	SC-QE06-SD-1001	(0.00,0.50)	J	40.9
Olean-12-ene	0.63	SC-QW03-SD-1001	(0.00,0.50)	J	16.1
Olean-18-ene	0.82	SC-QE09-SD-902	(0.50,1.00)	J	19.1
Oxirane, hexadecyl-	0.4	SC-QE08-SD-902	(0.50,1.00)	J	22.2
Oxygenated Hydrocarbon	17	SC-QE02-SD-901	(0.00,0.50)	J	15.6
P-Terphenyl, 2,4,4",6-tetrachloro-	1.7	SC-QE07-SD-901	(0.00,0.50)	J	17.7
Pentacosane	15	SC-QE08-SD-1001	(0.00,0.50)	J	60.1
Pentadecane	4.9	SC-QE08-SD-1001	(0.00,0.50)	J	60.1
Pentadecane, 2,6,10,14-tetramethyl-	11	SC-QE06-SD-902	(0.50,1.00)	J	46.6
Pentalene, octahydro-1-(2-octyldecyl)-	2.6	SC-QW04-SD-902	(0.50,1.00)	J	43.1
Pentatriacontane	0.52	SC-QE05-SD-1001	(0.00,0.50)	J	23.1
Perylene	7.8	SC-QE08-SD-901	(0.00,0.50)	J	59.1
Phenanthrene, 2-methyl-	1.1	SC-QE03-SD-1001	(0.00,0.50)	J	19.0
Phenanthrene, 3-methyl-	0.99	SC-QW05-SD-901	(0.00,0.50)	J	25.0
Phenanthrene, 7-ethenyl-1,2,3,4,4a,4b,5-,6,7,8,8	0.65	SC-QW03-SD-1001	(0.00,0.50)	Jz	16.1
Phenol, 2,4-bis(1-methylethyl)-	0.75	SC-QE11-SD-901	(0.00,0.50)	J	16.8
Phenol, 2-(1,1-dimethylethyl)-	3.2	SC-QE10-SD-901	(0.00,0.50)	J	16.0
Phenol, 2-(1,1-dimethylethyl)-5-methyl-	0.85	SC-QE11-SD-902	(0.50,1.00)	J	13.5
Phenol, 2-methyl-5-(1-methylethyl)-	1.4	SC-QE11-SD-901	(0.00,0.50)	J	16.8
Phenol, 4,4'-butylidenebis[2-(1,1-dimethylethyl)	1.1	SC-QW01-SD-1002	(0.50,1.00)	Jz	11.1
Phenol, 4-(1,1,3,3-tetramethylbutyl)-	2.6	SC-QW03-SD-903	(1.00,2.00)	J	23.9
Phenol, 4-(1,1-dimethylpropyl)-	3.7	SC-QE09-SD-1002	(0.50,1.00)	J	26
Phenol, 4-(2,2,3,3-tetramethylbutyl)-	6.1	SC-QW03-SD-902	(0.50,1.00)	J	52.5
Phenol, 4-(2,2,4-trimethylpentyl)-	1.9	SC-QE10-SD-901	(0.00,0.50)	J	16.0
Phenol, 4-(2-methylpropyl)-	6.3	SC-QE09-SD-1002	(0.50,1.00)	J	26
Phenol, 4-dodecyl-	5.7	SC-QE09-SD-1002	(0.50,1.00)	J	26
Phenol, 4-nonyl-	5.9	SC-QE09-SD-1002	(0.50,1.00)	J	26

TABLE B-10
MAXIMUM DETECTED CONCENTRATIONS AND ASSOCIATED SAMPLE LOCATIONS
FOR TENTATIVELY IDENTIFIED COMPOUNDS IN SEDIMENT SAMPLES
THIRD YEAR LONG-TERM MONITORING

Analyte	Result	Client Description		Footnotes	% Water
Phenol, 5-methoxy-2-(3,4,9,10-tetrahydro-8,8-dim!	1.9	SC-QE02-SD-1001	(0.00,0.50)	Jz	26.8
Phenol, chloro-4-(1,1-dimethylethyl)-,acetate	0.29	SC-QE10-SD-903	(0.00,3.00)	J	16.8
Phenol, m-tert-butyl-	3.2	SC-QE09-SD-1002	(0.50,1.00)	J	26
Phenol, nonyl-	6.8	SC-QE10-SD-901	(0.00,0.50)	J	16.0
Phenol-2,6-dimethoxy-4-(2-propenyl)-	2.3	SC-QE01-SD-1001	(0.00,0.50)	J	55.6
Phenothiazino[4,3-c]phenothiazine,8,16-dihydro-	0.27	SC-QE07-SD-1001	(0.00,0.50)	J	21
Phosphonic acid, 1,3-propanediylbis-,tetraethyl !	1.9	SC-QE09-SD-1001	(0.00,0.50)	Jz	38.7
Phosphonic difluoride,(pentafluorophenyl)-	1.6	SC-QE09-SD-1001	(0.00,0.50)	J	38.7
Phosphoric acid, 2-ethylhexyl diphenyl ester	5.8	SC-QW04-SD-903	(2.00,2.50)	J	38.5
Phthalic acid, allyl ethyl ester	21	SC-QW05-SD-901	(0.00,0.50)	J	25.0
Phthalic anhydride	1.8	SC-QE02-SD-1001	(0.00,0.50)	J	26.8
Polynuclear Aromatic Hydrocarbon	2.5	SC-QE03-SD-901	(0.00,0.50)	J	44.4
Propane, 1,3-bis(ethylthio)-	9.5	SC-QE09-SD-1002	(0.50,1.00)	J	26
Pyrazine, 3,5-diethyl-2-methyl-	3.2	SC-QW05-SD-901	(0.00,0.50)	J	25.0
Saturated Hydrocarbon	11	SC-QW04-SD-903	(2.00,2.50)	J	38.5
Silane, chlorotripropyl-	0.7	SC-QE11-SD-902	(0.50,1.00)	J	13.5
Siloxane	14	SC-QE02-SD-902	(0.50,1.00)	J	17.0
Squalene	5.8	SC-QE03-SD-901	(0.00,0.50)	J	44.4
Stannane, chlorotris(2-methylpropyl)-	4.9	SC-QE03-SD-901	(0.00,0.50)	J	44.4
Sterol	1.9	SC-QW07-SD-901	(0.00,0.50)	J	24.3
Stigmast-4-en-3-one	0.47	SC-QW03-SD-1001	(0.00,0.50)	J	16.1
Stigmast-5-en-3-ol-, (3.beta.,24S)-	6.9	SC-QW02-SD-901	(0.00,0.50)	J	69.8
Sulfur, mol. (S8)	11	SC-QE02-SD-1001	(0.00,0.50)	J	26.8
Terphenyl, 2,5,4-trichloro-	0.41	SC-QE07-SD-1001	(0.00,0.50)	J	21
Tetracosane	15	SC-QE06-SD-1001	(0.00,0.50)	J	40.9
Tetracosatetraene, 2,6,10,15,19,23-hexamethyl-	0.35	SC-QE07-SD-1001	(0.00,0.50)	J	21
Tetradecanal	3.7	SC-QE10-SD-901	(0.00,0.50)	J	16.0
Tetradecane	8	SC-QE08-SD-1002	(0.50,1.00)	J	30.9
Tetradecane, 1-bromo-	0.47	SC-QE09-SD-901	(0.00,0.50)	J	22.4
Tetratetracontane	2.7	SC-QE06-SD-903	(1.00,1.50)	J	25.8
Toluene, 4-acetylamino-	2.5	SC-QE10-SD-901	(0.00,0.50)	J	16.0
Triacontane	0.98	SC-QE02-SD-902	(0.50,1.00)	J	17.0
Tricosane	14	SC-QE08-SD-901	(0.00,0.50)	J	59.1
Tricyclo[4.3.0.07,9]nonane, 2,2,5,5,8,8-hexamet!	7	SC-QE03-SD-901	(0.00,0.50)	Jz	44.4
Tricyclo[4.3.1.13,8]undecane,1-chloro-	2.7	SC-QW04-SD-903	(2.00,2.50)	J	38.5
Tricyclo[4.3.1.13,8]undecane-3-carboxylic acid, !	5.6	SC-QE06-SD-1002	(0.50,1.00)	Jz	41.4
Tridecane	6.9	SC-QE06-SD-901	(0.00,0.50)	J	66.0
Tridecane, 2-methyl-	1.3	SC-QE02-SD-902	(0.50,1.00)	J	17.0
Tridecane, 5-propyl-	6.4	SC-QE06-SD-902	(0.50,1.00)	J	46.6
Tridecane, 6-propyl-	0.38	SC-QE01-SD-901	(0.00,0.50)	J	17.1
Tridecanol	0.73	SC-QE09-SD-901	(0.00,0.50)	J	22.4
Triphenylene	1.7	SC-QW05-SD-901	(0.00,0.50)	J	25.0
Tritetracontane	8.4	SC-QE06-SD-902	(0.50,1.00)	J	46.6
Undecane, 2,5-dimethyl-	2	SC-QE06-SD-903	(1.00,1.50)	J	25.8
Undecane, 2,6-dimethyl-	7.4	SC-QE08-SD-901	(0.00,0.50)	J	59.1
Undecane, 2,8-dimethyl-	7.6	SC-QE08-SD-1002	(0.50,1.00)	J	30.9
Undecane, 2-methyl-	3.7	SC-QE08-SD-1002	(0.50,1.00)	J	30.9
Undecane, 3,6-dimethyl-	2.2	SC-QW03-SD-902	(0.50,1.00)	J	52.5
Undecane, 3,8-dimethyl-	0.89	SC-QE02-SD-902	(0.50,1.00)	J	17.0
Undecane, 4,6-dimethyl-	0.63	SC-QE08-SD-902	(0.50,1.00)	J	22.2
Undecane, 4-methyl-	4.2	SC-QE08-SD-1002	(0.50,1.00)	J	30.9
Unknown	0.41	SC-TR01-SD-901	(0.00,0.50)	J	31.5

TABLE B-10
MAXIMUM DETECTED CONCENTRATIONS AND ASSOCIATED SAMPLE LOCATIONS
FOR TENTATIVELY IDENTIFIED COMPOUNDS IN SEDIMENT SAMPLES
THIRD YEAR LONG-TERM MONITORING

Analyte	Result	Client Description	Footnotes	% Water
Unsaturated Hydrocarbon	3.3	SC-QE10-SD-901 (0.00,0.50)	J	16.0
Urs-12-ene	0.91	SC-QE09-SD-1001 (0.00,0.50)	J	38.7
Urs-12-ene, 3-methoxy-, (3.beta.)-	0.47	SC-QW07-SD-1002 (0.50,1.00)	J	18.9
Urs-20-en-16-ol, (16.beta.,18.alpha.,19.alpha.)-	2.9	SC-QW02-SD-901 (0.00,0.50)	J	69.8
Vitamin E	14	SC-QE06-SD-901 (0.00,0.50)	J	66.0
Volatile Organics (mg/kg)				
alpha.-Pinene	0.0065	SC-QW07-SD-1001 (0.00,0.50)	J	10.2
1,1,3,3,5-pentamenthylcyclohexane	0.43	SC-QE02-SD-1001 (0.00,0.50)	J	26.8
1,1,4-Trimethylcyclohexane	0.047	SC-QE06-SD-903 (1.00,1.50)	J	25.8
1,2,4-Trimethylbenzene	0.0085	SC-QE06-SD-903 (1.00,1.50)	J	25.8
1,2-Dichlorobenzene	0.088	SC-QE02-SD-902 (0.50,1.00)	J	17.0
1,3-Dichlorobenzene	0.022	SC-QE03-SD-1001 (0.00,0.50)	J	19.0
1,4-Dichlorobenzene	0.03	SC-QE03-SD-1001 (0.00,0.50)	J	19.0
1-bromoadamantane	1.9	SC-QE02-SD-1001 (0.00,0.50)	J	26.8
1-Decene	0.017	SC-QW02-SD-901 (0.00,0.50)	J	69.8
1-Ethyl-3-methylcyclohexane (c,t)	0.034	SC-QE06-SD-1001 (0.00,0.50)	J	40.9
1-Methylnaphthalene	0.012	SC-QE09-SD-1001 (0.00,0.50)	J	38.7
1-Pentene, 2,4,4-trimethyl-	0.013	SC-QW04-SD-903 (2.00,2.50)	J	38.5
1H-Indene, 2,3-dihydro-1,3-dimethyl-	0.0082	SC-QE10-SD-1001 (0.00,0.50)	J	20.2
2-Bicyclo[4.3.1]decan-10-one	0.022	SC-QE09-SD-902 (0.50,1.00)	J	19.1
2-Octene, 2,6-dimethyl-	0.017	SC-QE08-SD-1001 (0.00,0.50)	J	60.1
3,5-Dimethyl-3-heptene	0.083	SC-QW03-SD-902 (0.50,1.00)	J	52.5
4,7-Methano-1H-indene, octahydro-	0.022	SC-QW05-SD-1001 (0.00,0.50)	J	19.9
4-tert-Butyltoluene	0.0072	SC-QE10-SD-1001 (0.00,0.50)	J	20.2
4-Undecene, 6-methyl-	0.066	SC-QW03-SD-902 (0.50,1.00)	J	52.5
5-Eicosyne	0.0023	SC-QE08-SD-1001 (0.00,0.50)	J	60.1
Adamantane, 1,3-dimethyl-	1.6	SC-QE02-SD-1001 (0.00,0.50)	J	26.8
Aromatic Hydrocarbon	0.17	SC-QE06-SD-901 (0.00,0.50)	J	66.0
Azulene	0.33	SC-QE07-SD-1002 (0.50,1.00)	J	19
Benzene, (1,1-dimethylpropyl)-	0.012	SC-QE07-SD-1003 (0.00,2.00)	J	22.6
Benzene, (1-ethylpropyl)-	0.0075	SC-QE07-SD-1002 (0.50,1.00)	J	19
Benzene, (2-methyl-1-butenyl)-	0.0088	SC-QE11-SD-1002 (0.50,1.00)	J	19.6
Benzene, 1,2,4,5-tetramethyl-	0.049	SC-QE11-SD-1002 (0.50,1.00)	J	19.6
Benzene, 1,2-diethyl-	0.035	SC-QE07-SD-1002 (0.50,1.00)	J	19
Benzene, 1,3-dimethyl-5-(1-methylethyl)-	0.0071	SC-QE07-SD-901 (0.00,0.50)	J	17.7
Benzene, 1,4-diethyl-	0.0073	SC-QE07-SD-901 (0.00,0.50)	J	17.7
Benzene, 1-ethyl-2,3-dimethyl-	0.035	SC-QE08-SD-902 (0.50,1.00)	J	22.2
Benzene, 1-ethyl-2,4-dimethyl-	0.0074	SC-QE07-SD-1001 (0.00,0.50)	J	21
Benzene, 1-ethyl-3,5-dimethyl-	0.028	SC-QW02-SD-901 (0.00,0.50)	J	69.8
Benzene, 1-ethyl-3-(1-methylethyl)-	0.023	SC-QW02-SD-901 (0.00,0.50)	J	69.8
Benzene, 1-ethyl-4-(1-methylethyl)-	0.018	SC-QE07-SD-1002 (0.50,1.00)	J	19
Benzene, 1-methyl-2-(1-methylethyl)-	0.036	SC-QE07-SD-1002 (0.50,1.00)	J	19
Benzene, 1-methyl-3-(1-methylethyl)-	3.3	SC-QE08-SD-1002 (0.50,1.00)	J	30.9
Benzene, 1-methyl-3-propyl-	0.012	SC-QE07-SD-1002 (0.50,1.00)	J	19
Benzene, 2,4-dimethyl-1-(1-methylethyl)-	0.0082	SC-QE07-SD-1001 (0.00,0.50)	J	21
Benzene, 2-ethyl-1,3-dimethyl-	0.057	SC-QE08-SD-902 (0.50,1.00)	J	22.2
Benzene, 4-ethyl-1,2-dimethyl-	0.022	SC-QE07-SD-1003 (0.00,2.00)	J	22.6
Benzene, diethyl-	0.0093	SC-QE06-SD-903 (1.00,1.50)	J	25.8
Bicyclo[2.2.1]heptane, 2-butyl-	0.0066	SC-QE11-SD-902 (0.50,1.00)	J	13.5
Bicyclo[3.3.1]nonane	0.015	SC-QE11-SD-1002 (0.50,1.00)	J	19.6
Bicyclo[4.1.0]heptan-3-one, 4,7,7-trimethyl-, [1R'	0.35	SC-QE06-SD-902 (0.50,1.00)	JZ	46.6
Bromofluoromethane	0.047	SC-QE06-SD-901 (0.00,0.50)	J	66.0

TABLE B-10
MAXIMUM DETECTED CONCENTRATIONS AND ASSOCIATED SAMPLE LOCATIONS
FOR TENTATIVELY IDENTIFIED COMPOUNDS IN SEDIMENT SAMPLES
THIRD YEAR LONG-TERM MONITORING

Analyte	Result	Client Description		Footnotes	% Water
cis-1,2-Dichloroethene	0.018	SC-QW04-SD-902	(0.50,1.00)	J	43.1
cis-1-Ethyl-3-methyl-cyclohexane	0.057	SC-QE06-SD-1002	(0.50,1.00)	J	41.4
Cyclic Hydrocarbon	1.4	SC-QE02-SD-1001	(0.00,0.50)	J	26.8
Cyclodecene	0.06	SC-QE06-SD-901	(0.00,0.50)	J	66.0
Cycloheptane, methyl-	0.098	SC-QE06-SD-901	(0.00,0.50)	J	66.0
Cyclohexane, (2-methylpropyl)-	0.012	SC-QE05-SD-1001	(0.00,0.50)	J	23.1
Cyclohexane, 1,1,2,3-tetramethyl-	0.012	SC-QE06-SD-903	(1.00,1.50)	J	25.8
Cyclohexane, 1,1,2-trimethyl-	0.081	SC-QE06-SD-902	(0.50,1.00)	J	46.6
Cyclohexane, 1,1,3,5-tetramethyl-,trans-	0.0081	SC-QW02-SD-902	(0.50,1.00)	J	22.5
Cyclohexane, 1,1,3-trimethyl-	2.4	SC-QE08-SD-1002	(0.50,1.00)	J	30.9
Cyclohexane, (1,1-dimethyl-2-propyl-	0.076	SC-QE06-SD-1002	(0.50,1.00)	J	41.4
Cyclohexane, 1,2,3-trimethyl-	0.055	SC-QW03-SD-901	(0.00,0.50)	J	33.8
Cyclohexane, 1,2,3-trimethyl-, (1.alpha.,2.alpha.	0.018	SC-QE06-SD-901	(0.00,0.50)	J	66.0
Cyclohexane, 1,2,3-trimethyl-,(1.alpha.,2.beta!	0.04	SC-QE06-SD-1002	(0.50,1.00)	J	41.4
Cyclohexane, 1,2,4-trimethyl-	0.055	SC-QW03-SD-901	(0.00,0.50)	J	33.8
Cyclohexane, 1,2,4-trimethyl-,(1.alpha.,2.beta.,!	0.027	SC-QE06-SD-1001	(0.00,0.50)	J	40.9
Cyclohexane, 1,2-diethyl-1-methyl-	1.4	SC-QE02-SD-1001	(0.00,0.50)	J	26.8
Cyclohexane, 1,2-diethyl-3-methyl-	1.2	SC-QE08-SD-1002	(0.50,1.00)	J	30.9
Cyclohexane, 1,2-dimethyl-, cis-	0.0072	SC-QE06-SD-903	(1.00,1.50)	J	25.8
Cyclohexane, 1,3-dimethyl-, trans-	3.2	SC-QE08-SD-1002	(0.50,1.00)	J	30.9
Cyclohexane, 1,4-dimethyl-	0.046	SC-QE06-SD-1002	(0.50,1.00)	J	41.4
Cyclohexane, 1-ethyl-2-methyl-, cis-	0.064	SC-QW03-SD-901	(0.00,0.50)	J	33.8
Cyclohexane, 1-ethyl-4-methyl-, cis-	0.11	SC-QE06-SD-902	(0.50,1.00)	J	46.6
Cyclohexane, 1-ethyl-4-methyl-,trans-	5	SC-QE08-SD-1002	(0.50,1.00)	J	30.9
Cyclohexane, 1-methyl-2-propyl-	0.18	SC-QE06-SD-902	(0.50,1.00)	J	46.6
Cyclohexane, 2,4-diethyl-1-methyl-	0.099	SC-QE06-SD-901	(0.00,0.50)	J	66.0
Cyclohexane, 2-butyl-1,1,3-trimethyl-	0.12	SC-QE06-SD-1001	(0.00,0.50)	J	40.9
Cyclohexane, 2-ethyl-1,3-dimethyl-	0.011	SC-QE02-SD-902	(0.50,1.00)	J	17.0
Cyclohexane, butyl-	1.7	SC-QE08-SD-1002	(0.50,1.00)	J	30.9
Cyclohexane, ethyl-	0.012	SC-QE07-SD-1001	(0.00,0.50)	J	21
Cyclohexane, hexyl-	0.021	SC-QW03-SD-901	(0.00,0.50)	J	33.8
Cyclohexane, methyl-	13	SC-QE08-SD-1002	(0.50,1.00)	J	30.9
Cyclohexane, pentyl-	0.19	SC-QW03-SD-903	(1.00,2.00)	J	23.9
Cyclohexane, propyl-	3.1	SC-QE08-SD-1002	(0.50,1.00)	J	30.9
Cyclohexanone, 2-ethyl-	0.091	SC-QE06-SD-1002	(0.50,1.00)	J	41.4
Cyclohexanone, 2-methyl-5-(1-methylethenyl)-, tr!	0.02	SC-QE09-SD-902	(0.50,1.00)	Jz	19.1
Cyclopentane, 1-methyl-1-(2-methyl-2-propenyl)-	0.22	SC-QE02-SD-1001	(0.00,0.50)	J	26.8
Cyclopentane, 1-methyl-2-propyl-	0.012	SC-QE11-SD-1002	(0.50,1.00)	J	19.6
Cyclopentane, 1-methyl-3-(2-methylpropyl)-	1.2	SC-QE08-SD-1002	(0.50,1.00)	J	30.9
Cyclopropane, 1,2-dimethyl-, trans-	0.0081	SC-QE06-SD-903	(1.00,1.50)	J	25.8
Cyclopropane, 1-(2-methylbutyl)-1-methylpropyl)-	0.033	SC-QE02-SD-902	(0.50,1.00)	J	17.0
Cyclopropane, 1-butyl-1-methyl-2-propyl-	0.039	SC-QW03-SD-901	(0.00,0.50)	J	33.8
Cyclopropane, 1-methyl-2-pentyl-	0.014	SC-QE02-SD-902	(0.50,1.00)	J	17.0
Cylohexane, 1,3,5-trimethyl-	0.0069	SC-QW02-SD-902	(0.50,1.00)	J	22.5
Decane	0.013	SC-QW04-SD-903	(2.00,2.50)	J	38.5
Decane, 2,6,6-trimethyl-	0.011	SC-QE02-SD-902	(0.50,1.00)	J	17.0
Decane, 2-methyl-	0.0076	SC-QE10-SD-1002	(0.50,1.00)	J	19.7
Decane, 3,3,4-trimethyl-	0.16	SC-QE08-SD-1001	(0.00,0.50)	J	60.1
Decane, 3-methyl-	1.2	SC-QE08-SD-1002	(0.50,1.00)	J	30.9
Decane, 4-methyl-	0.4	SC-QE06-SD-902	(0.50,1.00)	J	46.6
Dodecane	0.032	SC-QE05-SD-1001	(0.00,0.50)	J	23.1
Dodecane, 3-methyl-	0.084	SC-QE06-SD-1001	(0.00,0.50)	J	40.9

TABLE B-10
MAXIMUM DETECTED CONCENTRATIONS AND ASSOCIATED SAMPLE LOCATIONS
FOR TENTATIVELY IDENTIFIED COMPOUNDS IN SEDIMENT SAMPLES
THIRD YEAR LONG-TERM MONITORING

Analyte	Result	Client Description		Footnotes	% Water
Dodecane, 6-methyl-	0.12	SC-QE06-SD-1002	(0.50,1.00)	J	41.4
Heptane	6.4	SC-QE08-SD-1002	(0.50,1.00)	J	30.9
Heptane, 2-methyl-	12	SC-QE08-SD-1002	(0.50,1.00)	J	30.9
Heptane, 3-ethyl-2-methyl-	0.17	SC-QW03-SD-902	(0.50,1.00)	J	52.5
Heptane, 4-propyl-	0.007	SC-QE09-SD-902	(0.50,1.00)	J	19.1
Heptane, 5-ethyl-2-methyl-	0.013	SC-QE09-SD-902	(0.50,1.00)	J	19.1
Hexane	0.17	SC-QE08-SD-1001	(0.00,0.50)	J	60.1
n-Amylcyclohexane	0.12	SC-QE06-SD-1002	(0.50,1.00)	J	41.4
n-Propylbenzene	0.011	SC-QE11-SD-1002	(0.50,1.00)	J	19.6
Naphthalene	0.19	SC-QE07-SD-1001	(0.00,0.50)	J	21
Naphthalene, 1,2,3,4-tetrahydro-1-methyl-	0.0093	SC-QE10-SD-1001	(0.00,0.50)	J	20.2
Naphthalene, 1,2,3,4-tetrahydro-5-methyl-	0.0095	SC-QE10-SD-1001	(0.00,0.50)	J	20.2
Naphthalene, decahydro-	0.14	SC-QW03-SD-902	(0.50,1.00)	J	52.5
Naphthalene, decahydro-, trans-	3.7	SC-QE08-SD-1002	(0.50,1.00)	J	30.9
Naphthalene, decahydro-2,3-dimethyl-	0.063	SC-QE01-SD-1001	(0.00,0.50)	J	55.6
Naphthalene, decahydro-2,6-dimethyl-	0.32	SC-QE01-SD-1001	(0.00,0.50)	J	55.6
Naphthalene, decahydro-2-methyl-	2.7	SC-QE08-SD-1002	(0.50,1.00)	J	30.9
Nonane, 2-methyl-	0.029	SC-QE05-SD-1001	(0.00,0.50)	J	23.1
Nonane, 2-methyl-3-methylene-	0.039	SC-QE06-SD-901	(0.00,0.50)	J	66.0
Nonane, 3-methyl-	0.011	SC-QE02-SD-901	(0.00,0.50)	J	15.6
Nonane, 5-butyl-	0.091	SC-QE06-SD-1001	(0.00,0.50)	J	40.9
Nonane, 5-methyl-5-propyl-	0.069	SC-QE06-SD-1002	(0.50,1.00)	J	41.4
Octane	3.6	SC-QE08-SD-1002	(0.50,1.00)	J	30.9
Octane, 2,3,6-trimethyl-	0.085	SC-QE06-SD-901	(0.00,0.50)	J	66.0
Octane, 2,6-dimethyl-	0.036	SC-QE06-SD-1001	(0.00,0.50)	J	40.9
Octane, 3,6-dimethyl-	2.5	SC-QE08-SD-1002	(0.50,1.00)	J	30.9
Octane, 3-ethyl-	0.094	SC-QW03-SD-903	(1.00,2.00)	J	23.9
Octane, 3-methyl-	2	SC-QE08-SD-1002	(0.50,1.00)	J	30.9
Octane, 4-ethyl-	0.071	SC-QW03-SD-902	(0.50,1.00)	J	52.5
Octane, 4-methyl-	3.7	SC-QE08-SD-1002	(0.50,1.00)	J	30.9
Octane, 6-ethyl-2-methyl-	0.053	SC-QE06-SD-901	(0.00,0.50)	J	66.0
Oxygenated Hydrocarbon	0.17	SC-QW03-SD-903	(1.00,2.00)	J	23.9
p-Isopropyltoluene (p-Cymene)	0.069	SC-QE07-SD-1002	(0.50,1.00)	J	19
Saturated Hydrocarbon	0.76	SC-QE06-SD-902	(0.50,1.00)	J	46.6
sec-Butylbenzene	0.016	SC-QE11-SD-1002	(0.50,1.00)	J	19.6
Siloxane	0.47	SC-QW03-SD-902	(0.50,1.00)	J	52.5
Tricyclo[3.3.1.13,7]decane	0.95	SC-QE02-SD-1001	(0.00,0.50)	J	26.8
Tridecane	0.42	SC-QE06-SD-1001	(0.00,0.50)	J	40.9
Undecane	0.026	SC-QW04-SD-903	(2.00,2.50)	J	38.5
Undecane, 4,6-dimethyl-	0.17	SC-QW03-SD-902	(0.50,1.00)	J	52.5
Undecane, 4,7-dimethyl-	0.024	SC-QE01-SD-1001	(0.00,0.50)	J	55.6
Undecane, 6,6-dimethyl-	0.015	SC-QE06-SD-901	(0.00,0.50)	J	66.0
Unknown	8.1	SC-QE02-SD-1001	(0.00,0.50)	J	26.8
Unsaturated Hydrocarbon	0.49	SC-QE06-SD-902	(0.50,1.00)	J	46.6

TABLE B-11
STATISTICAL EVALUATION OF ANALYTES
TENTATIVELY IDETIFIED IN SURFACE WATER
THIRD YEAR LONG-TERM MONITORING

Analyte	Frequency of Detection	Average Result	Maximum Result	Minimum Result
Semivolatile Organics - Method 8270 (mg/L)				
1,1,2,2-Tetrachloroethane	1	3.229	9.6	0.017
1,1,2-Trichloroethane	1	0.033	0.033	0.033
1,2-Propanediamine	1	0.006	0.0063	0.0063
1,3,5-Cycloheptatriene	1	0.005	0.0047	0.0047
1,3-Cyclopentanedione, 2-bromo-	3	0.010	0.017	0.0067
1,3-Propanediol, 2,2-dimethyl-	1	0.006	0.006	0.006
1-Hexanol, 2-ethyl-	1	0.006	0.006	0.006
1-Propene, 1,2,3,3-tetrachloro-	1	0.016	0.016	0.016
1-Propene, 1,1,2,3-tetrachloro-	1	0.290	0.29	0.29
1H-Indol-5-ol	5	0.059	0.091	0.012
2,4-Imidazolidinedione, 1-(hydroxymethyl)-5,5-di	1	0.004	0.004	0.004
2-Butenoic acid, 4-nitrophenyl ester, (E)-	1	0.004	0.0041	0.0041
2-Pentanol, 3-methyl-	1	0.041	0.041	0.041
2-Pyridinecarbonitrile	10	0.010	0.052	0.0042
2-Pyrrolidinone, 1-methyl-	3	0.029	0.075	0.0046
2H-Cyclopenta[d]pyridazine, 2-methyl-	1	0.082	0.082	0.082
2H-Inden-2-one, 1,3-dihydro-	1	0.005	0.0046	0.0046
2H-Indol-2-one, 1,3-dihydro-	13	0.058	0.25	0.0074
3-Hexanol, 4-methyl-	2	0.034	0.041	0.027
3-Hydroxy-3-methyl-2-butanone	5	0.012	0.026	0.0047
3-Methyl-3-chloro-1-butene	1	0.017	0.017	0.017
3-Pyridinecarbonitrile	1	0.008	0.0081	0.0081
4-Morpholinepropanamine	1	0.018	0.018	0.018
4-Pyridinecarbonitrile	6	0.011	0.032	0.0043
5,6-Decanedione	1	0.011	0.018	0.0049
Benzene, 1-isocyanato-2-methyl-	1	0.031	0.031	0.031
Benzene, 1-isocyanato-3-methyl-	3	0.028	0.042	0.0023
Benzene, 1-isocyanato-4-methyl-	1	0.040	0.04	0.04
Benzene, dichloromethoxy-	1	0.010	0.0096	0.0096
Butanamide	3	0.011	0.018	0.0078
Butane, 2,3-dichloro-2-methyl-	1	0.005	0.0045	0.0045
Butane, 2-methoxy-2-methyl-	7	0.139	0.18	0.086
Butane, 2-methoxy-2-methyl-	2	0.110	0.12	0.1
Cyclooctane	1	0.006	0.0062	0.0062
Ethanol, 2-(2-methoxyethoxy)-	2	0.009	0.012	0.0053
Ethanol, 2-(diethylamino)-	1	0.410	0.41	0.41
Ethanol, 2-butoxy-	5	0.007	0.009	0.0041
Ethylene, 1-bromo-2-chloro-1,2-difluoro-	1	0.010	0.01	0.01
Formic acid, hexyl ester	1	0.010	0.0097	0.0097
Furan, tetrahydro-3-methyl-	4	0.037	0.055	0.012
Halogenated Compound	1	0.008	0.01	0.0055
Heptanoic acid, 3-nitrophenyl ester	1	0.020	0.02	0.02
Heptanoic acid, anhydride	2	0.011	0.017	0.005

TABLE B-11
STATISTICAL EVALUATION OF ANALYTES
TENTATIVELY IDETIFIED IN SURFACE WATER
THIRD YEAR LONG-TERM MONITORING

Analyte	Frequency of Detection	Average Result	Maximum Result	Minimum Result
Hexadecane	1	0.005	0.005	0.005
Hexadecane, 2,6,11,15-tetramethyl-	1	0.005	0.005	0.005
Isopropylamine	1	0.006	0.006	0.006
Methylene chloride	2	0.450	0.58	0.32
Morpholine	4	0.159	0.75	0.0061
Morpholine, 4-methyl-	1	0.009	0.0091	0.0091
Nitrogen Compound	3	0.016	0.039	0.0041
Nitrogen Compound	7	0.005	0.0079	0.004
Octanethioic acid, S-hexyl ester	2	0.018	0.032	0.0046
Oxygenated Hydrocarbon	5	0.023	0.056	0.0052
Pentachloroethane	1	0.190	0.19	0.19
Propane, 2-ethoxy-2-methyl-	3	0.039	0.055	0.027
Propylene Glycol	2	0.099	0.14	0.058
Saturated Hydrocarbon	3	0.021	0.06	0.0041
Silacyclohexane, 1,1-dimethyl-	1	0.010	0.01	0.01
Toluene	1	0.021	0.021	0.021
Trichloroethene	1	0.600	0.6	0.6
Unknown	3	0.020	0.045	0.0065
Volatile Organics - Method 8260 (mg/L)				
Butanoic acid, 3-methyl-	1	0.013	0.013	0.013
Siloxane	4	0.008	0.016	0.0058
Urea	1	0.006	0.0061	0.0061

TABLE B-12
MAXIMUM DETECTED CONCENTRATIONS AND ASSOCIATED SAMPLE LOCATIONS FOR TENTATIVELY IDENTIFIED COMPOUNDS IN SURFACE WATER THIRD YEAR LONG-TERM MONITORING

Analyte	Result	Client Description	Footnotes
Semivolatile Organics - Method 8270 (mg/L)			
1,1,2,2-Tetrachloroethane	9.6	SC-QE09-SW-1001 (0.00,0.00)	J
1,1,2-Trichloroethane	0.033	SC-QE09-SW-1001 (0.00,0.00)	J
1,2-Propanediamine	0.0063	SC-QE10-SW-1001 (0.00,0.00)	J
1,3,5-Cycloheptatriene	0.0047	SC-QE08-SW-1001 (0.00,0.00)	J
1,3-Cyclopentanedione, 2-bromo-	0.017	SC-QE04-SW-1001 (0.00,0.00)	J
1,3-Propanediol, 2,2-dimethyl-	0.006	SC-QE03-SW-901 (0.00,0.00)	J
1-Hexanol, 2-ethyl-	0.006	SC-QW06-SW-901 (0.00,0.00)	J
1-Propene, 1,2,3,3-tetrachloro-	0.016	SC-QE09-SW-1001 (0.00,0.00)	J
1-Propene, 1,1,2,3-tetrachloro-	0.29	SC-QE09-SW-1001 (0.00,0.00)	J
1H-Indol-5-ol	0.091	SC-QE08-SW-901 (0.00,0.00)	J
2,4-Imidazolidinedione, 1-(hydroxymethyl)-5,5-di	0.004	SC-QE11-SW-1001 (0.00,0.00)	Jz
2-Butenoic acid, 4-nitrophenyl ester, (E)-	0.0041	SC-QE10-SW-1001 (0.00,0.00)	J
2-Pentanol, 3-methyl-	0.041	SC-QE09-SW-1001 (0.00,0.00)	J
2-Pyridinecarbonitrile	0.052	SC-QE02-SW-901 (0.00,0.00)	J
2-Pyrrolidinone, 1-methyl-	0.075	SC-QW03-SW-901 (0.00,0.00)	J
2H-Cyclopenta[d]pyridazine, 2-methyl-	0.082	SC-QE11-SW-1001 (0.00,0.00)	J
2H-Inden-2-one, 1,3-dihydro-	0.0046	SC-QE08-SW-1001 (0.00,0.00)	J
2H-Indol-2-one, 1,3-dihydro-	0.25	SC-QE02-SW-901 (0.00,0.00)	J
3-Hexanol, 4-methyl-	0.041	SC-QE04-SW-901 (0.00,0.00)	J
3-Hydroxy-3-methyl-2-butanone	0.026	SC-QE04-SW-1001 (0.00,0.00)	J
3-Methyl-3-chloro-1-butene	0.017	SC-QE09-SW-1001 (0.00,0.00)	J
3-Pyridinecarbonitrile	0.0081	SC-QE08-SW-901 (0.00,0.00)	J
4-Morpholinepropanamine	0.018	SC-QW05-SW-901 (0.00,0.00)	J
4-Pyridinecarbonitrile	0.032	SC-QE03-SW-901 (0.00,0.00)	J
5,6-Decanedione	0.018	SC-QE02-SW-901 (0.00,0.00)	J
Benzene, 1-isocyanato-2-methyl-	0.031	SC-QW06-SW-901 (0.00,0.00)	J
Benzene, 1-isocyanato-3-methyl-	0.042	SC-QE08-SW-1001 (0.00,0.00)	J
Benzene, 1-isocyanato-4-methyl-	0.04	SC-QE06-SW-1001 (0.00,0.00)	J
Benzene, dichloromethoxy-	0.0096	SC-QE04-SW-1001 (0.00,0.00)	J
Butanamide	0.018	SC-QE04-SW-1001 (0.00,0.00)	J
Butane, 2,3-dichloro-2-methyl-	0.0045	SC-QE07-SW-901 (0.00,0.00)	J
Butane, 2-methoxy-2-methyl-	0.12	SC-QE09-SW-1001 (0.00,0.00)	JB
Butane, 2-methoxy-2-methyl-	0.18	SC-QE06-SW-1001 (0.00,0.00)	J
Cyclooctane	0.0062	SC-QW05-SW-901 (0.00,0.00)	J
Ethanol, 2-(2-methoxyethoxy)-	0.012	SC-QE02-SW-1001 (0.00,0.00)	J
Ethanol, 2-(diethylamino)-	0.41	SC-QW03-SW-901 (0.00,0.00)	J
Ethanol, 2-butoxy-	0.009	SC-QE02-SW-1001 (0.00,0.00)	J
Ethylene, 1-bromo-2-chloro-1,2-difluoro-	0.01	SC-QE01-SW-901 (0.00,0.00)	J
Formic acid, hexyl ester	0.0097	SC-QW06-SW-901 (0.00,0.00)	J
Furan, tetrahydro-3-methyl-	0.055	SC-QE01-SW-901 (0.00,0.00)	J
Halogenated Compound	0.01	SC-QE01-SW-901 (0.00,0.00)	J
Heptanoic acid, 3-nitrophenyl ester	0.02	SC-QE02-SW-901 (0.00,0.00)	J
Heptanoic acid, anhydride	0.017	SC-QE02-SW-901 (0.00,0.00)	J
Hexadecane	0.005	SC-QE03-SW-1001 (0.00,0.00)	J

TABLE B-12
MAXIMUM DETECTED CONCENTRATIONS AND ASSOCIATED SAMPLE LOCATIONS
FOR TENTATIVELY IDENTIFIED COMPOUNDS IN SURFACE WATER
THIRD YEAR LONG-TERM MONITORING

Analyte	Result	Client Description	Footnotes
Hexadecane, 2,6,11,15-tetramethyl-	0.005	SC-QE03-SW-1001 (0.00,0.00)	J
Isopropylamine	0.006	SC-QE11-SW-1001 (0.00,0.00)	J
Methylene chloride	0.58	SC-QE10-SW-1001 (0.00,0.00)	J
Morpholine	0.75	SC-QW03-SW-901 (0.00,0.00)	J
Morpholine, 4-methyl-	0.0091	SC-QW03-SW-901 (0.00,0.00)	J
Nitrogen Compound	0.0079	SC-QE06-SW-1001 (0.00,0.00)	JB
Nitrogen Compound	0.039	SC-QE03-SW-901 (0.00,0.00)	J
Octanethioic acid, S-hexyl ester	0.032	SC-QE02-SW-901 (0.00,0.00)	J
Oxygenated Hydrocarbon	0.056	SC-QE07-SW-901 (0.00,0.00)	J
Pentachloroethane	0.19	SC-QE09-SW-1001 (0.00,0.00)	J
Propane, 2-ethoxy-2-methyl-	0.055	SC-QE01-SW-1001 (0.00,0.00)	J
Propylene Glycol	0.14	SC-QW06-SW-901 (0.00,0.00)	J
Saturated Hydrocarbon	0.06	SC-QE02-SW-901 (0.00,0.00)	J
Silacyclohexane, 1,1-dimethyl-	0.01	SC-QE03-SW-901 (0.00,0.00)	J
Toluene	0.021	SC-QE06-SW-901 (0.00,0.00)	J
Trichloroethene	0.6	SC-QE09-SW-1001 (0.00,0.00)	J
Unknown	0.045	SC-QE02-SW-901 (0.00,0.00)	J
Volatile Organics - Method 8260 (mg/L)			
Butanoic acid, 3-methyl-	0.013	SC-QW07-SW-901 (0.00,0.00)	J
Siloxane	0.016	SC-QE07-SW-901 (0.00,0.00)	J
Urea	0.0061	SC-QE02-SW-901 (0.00,0.00)	J